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EDITORIALS

Scientific Publicity

THE world's most famous gossip-writer, Mr. Walter Winchell, has included among his predictions the suggestion that the University of Toronto is about to announce a tested cure for cancer. According to the story, Toronto has known about the cure for years but has hesitated to tell the world until after a thorough check.

Mr. Winchell may, of course, only be gossip-writing. But a background of public attitude toward science which would permit such a prophecy is a sad commentary. There is something appalling about the mere suggestion that a great university would withhold information on so vital a subject. Would the object be to gain greater glory for the completed discovery, sacrificing in the meantime the good that might be done to other sufferers, and sacrificing also the speedier progress possible with the co-operation of additional experts? Or would the information be withheld to prevent the raising of false hopes? A grim cost for the sparing of a few feelings, surely.

Whatever the intelligence of the vast body of Mr. Winchell's readers, Mr. Winchell himself is an intelligent man. If an intelligent man really holds such an opinion of the medical profession, long regarded as the most ethical and self-sacrificing of the professions, is it any wonder that the public needs educating as to chemists?

Cooperation

THE discovery of synthetic rubber is interesting because of the final result; but it is still more interesting, from a professional viewpoint, because of the mechanism of the process. There have been few examples of such perfect cooperation of scholarship, capital, and commercial research—Father Nieuwland in his laboratory at Notre Dame, the du Pont money supporting further research, the du Pont chemists completing the discovery.

We realize how essential all these elements were when we consider the history of some of the products. In 1913, Richard Willstätter prepared vinyl acetylene by the decomposition of a quaternary ammonium compound, still the method recommended for the preparation of this compound for laboratory use. The discovery of synthetic rubber might

well have taken place at that time. It required, however, the practical mind of a commercial chemist contemplating Father Nieuwland's commercially feasible synthesis.

Had Willstätter himself taken this step, it might well have changed the history of the world. Many times during the war, the Germans stood on the point of breaking through to Paris. Lack of rubber was one of the greatest handicaps in preparing war materials. If Germany had had an unlimited supply of artificial rubber better than the natural product, would the history of the war have been different? Did a German chemist lose the war there in his laboratory?

Whatever the previous history, all credit is due the men and the organization who have synthesized DuPrene. Their cooperative effort is an example of the technique by which chemistry will advance most rapidly the welfare of the world. As Father Nieuwland himself says, the day of the lone wolf is over.

Professional Adaptability

A SPEAKER at a recent meeting of a scientific society deplored the fact that teachers in public high schools are required to study only one year of college chemistry before being permitted to teach the subject. The speaker advised the requiring of a full chemical education, with less emphasis on the pedagogical courses now being taught.

We are completely in favor of maintaining high educational standards, and we even admit that certain states require the study of an excessive amount of pedagogy; but we do feel that it is possible to go too far in demanding scientific education in a high school teacher.

The official excuse that most high school teachers have to teach all sciences is, of course, a very weak one if one year's study fails to equip the teacher adequately. We feel, however, that one or two courses do equip adequately and that our speaker is wrong in demanding more concentration on the study of science itself. How much does a teacher need to know about entropy, or the mechanism of keto-enol tautomerism to teach beginners in chemistry? If, after all, the purpose of a college education is to teach the mental attitude of an educated mind, do we not admit that our educational system is a failure when we say that a supposedly educated product of an American college is unable to adopt himself to the comparatively simple task of teaching high school chemistry?

In actual practice, we believe it will be found that the study of a large number of chemistry courses is not absolutely essential. We can think of

one college, noted for its high scholastic requirements, which hired a graduate student in history to teach physics—a task which the historian, an able, intelligent teacher, handled with great success, in spite of his almost complete initial ignorance of the science of physics.

Let us by all means insist upon intensive study of chemistry where this study is necessary, but let us not spoil our case by being unreasonable.

Nobel Prize

THE Nobel Prize Committee must be sufficiently tired by now of those who find fault with their decisions. It would seem, however, that the chemistry prize for 1931 has been misapplied. As we understand it, the prizes were established for the purpose of stimulating scientific men to constructive achievements and for the purpose of rewarding those whose efforts have met with success. There is some question in our mind as to the propriety of giving the award to a man who was spurred to his achievements by the tremendous war-created necessity for synthetic nitrogen.

There are certain fundamental objections to rewarding in this particular manner the men who achieve things in applied chemistry. Success in applied chemistry is apt to bring its own reward. Chemists inspired by the hope of great material profit from their process itself, or aided in their discoveries by all the resources of a nation in the throes of a great conflict, are somewhat unfair competition for the pure scientist.

The pure scientist seldom receives proportionate material reward even if his discoveries are proved to have immediate practical significance. It seems that the Nobel Prize might appropriately be reserved for him and for him alone.

The Chemist in the Cosmetic Industry

By R. F. Revson

The great possibilities for scientific men and scientific procedure in a large and growing branch of American industry.

WITH the enormous growth in the use of cosmetics in the last decade, the acquisition and retention of beauty has become big business. It was only a short time ago that lipsticks were hidden. Now they are revealed even in the most public places. Formerly the use of rouge was concealed even from husbands; now its employment is taught to children. In short, cosmetics, particularly colors, formerly the mark of the demi-monde, have become respectable. This does not mean a retrogression but rather a progression.

The public no longer attaches any moral significance to any improvement that cosmetics may render. It is true that most people do not use cosmetics either effectively or wisely, but that is beside the point, which is that women may now adorn themselves without fear of social ostracism.

For the purposes of this article we shall consider in the realm of cosmetics such items as perfumes, creams, rouges, lipsticks, hair preparations, face powders, etc. In a sense soaps should be included, but since conditions in soap factories differ somewhat, those will not be considered.

The last census gave the total value (wholesale) of production of cosmetics in this country as \$178,473,936. It is safe to say that the retail value would be at least 35% more, making a total of approximately \$250,000,000. This, of course, does not take into account beauty treatments administered by beauty shops, beauty specialists, dermatologists, etc. If we include these the figures might well amount to a billion dollars.

Not only, therefore, is cosmetics "big business" but it is increasing. No longer is it looked upon as luxury; cosmetics can perhaps be classified as semi-necessities. In this year of depression wherein the average industry has suffered losses of perhaps 35%, the cosmetic business will show a decrease of not over 15%—and that amount is possibly largely traceable to high-priced perfumes which are true luxuries. Moreover, it is likely that the coming years will see a vast increase in the use of cosmetics—massage creams, etc.—for men. As long as men and women take pride in personal appearance; so long as they believe advertisements and have sufficient money to purchase beautifying materials, cosmetics will be sold even though other items, more important to existance, suffer in sales. The cosmetic industry can be regarded as a stable one, although individual brands and concoctions are ephemeral.

What the Chemist Has Done

While the industry has much for which to thank the chemist, it is quite likely that most cosmeticians are not conscious of this debt. Most of the items employed in manufacture date from hundreds to thousands of years. Why? No one seems to know, unless it be inertia and lack of scientific guidance. We should exempt, of course, the perfume industry, which now employs possibly 50% of synthetics, the direct product of the chemical laboratory and of fundamental chemical research.

Without synthetics, perfumes would be much higher in price and available only in relatively small quantity. It is not necessary to tell of the work that has been done in this line. The perfumer, however, is, strictly speaking, not a chemist. As a matter of fact, the making of perfumes is largely an art. A discriminating nose is more valuable than a knowledge of Beilstein. In the realm of cosmetics proper come powders, pomades, creams, etc. These are made from talc, fats, waxes, zinc or titanium oxides, mineral oils, etc. An examination of contents of pomade jars found in tombs of Egypt indicates that the same general materials employed today were used in the time of Rameses.

The chemist, of course, has done much to purify and refine the materials from which cosmetics are made. Zinc oxide is available with only traces of lead present. Colors rivalling the rainbow, yet harmless, have displaced carmine and vegetable colors. Cocoa butter is available practically free from odor; the same is true of stearic acid. Lanolin may be had without a wool-fat smell. These are things that chemists have done in making the raw materials better for the cosmetician, who is for the most part blissfully unconscious of it.

Courtesy Givaudan-Delawanna Company

UNLOADING RAW MATERIALS

Of course the major field for the chemist is, or should be, in the development of methods or products. So far chemists in large numbers have not turned to this very fertile ground. Their chief contribution has been in making available new materials which the industry has been either too slow or too rapid in adopting.

In the relatively few places that have chemical control and research laboratories, colloid chemistry in the making of emulsions has been of great aid. Biological chemistry has contributed the vitamins, which is an instance of hasty adoption, for the merits of vitamins in cosmetics may reasonably be doubted. Organic chemistry has contributed antiseptics, preservatives, and fixatives, all of which have found more or less adoption. In most cosmetic laboratories, "phenol coefficient" is just words; in many, however, in particular those pharmaceutical houses that have gone in for the manufacture of a cosmetic line, the phenol coefficient is a real scientific instrument. In short, the chemist to date has largely confined his efforts to the making of materials suitable for the manufacture of cosmetics. Why, we shall see later.

Because of the rule-of-thumb formulas, there is almost a virgin field for the chemist. No industry needs chemistry quite so much and none is so ignorant of that need. Perhaps it may not be ignorance. If the

public will accept rule-of-thumb products, why pay professional talent to create others? Possibly 50% of all the cosmetics in the United States are made within the metropolitan area. Yet there are not more than fifteen chemists employed on purely cosmetic manufacture. "Who then makes cosmetics?" you will ask. The simplest answer is, "Anyone who can."

Cosmetics need improvement. All advertisements cannot be believed. Women purchase cosmetics by price, hopefully believing that price is an indication of quality in their Ponce de Leon quest. But is price a guarantee? Some of the products sold in two-ounce jars at $1.50 to $2.00 are offered in single ounces at the 5 and 10¢ stores.

The chemist can bring to cosmetics, first of all, ethics. It is not necessary that cosmetics be cheap, but they should be worthy and have greater real value. The chemist will recognize that certain materials now employed are not only hazardous, but in some instances even toxic. He will work in conjunction with the dermatologist so that items which, at best, are only innocuous may become helpful. It is very likely that within a relatively short time, there will be "ethical" cosmetics with formulas on labels that will take their places besides recognized ethical pharmaceuticals and will be prescribed by dermatologists.

Through his knowledge of physical chemistry the chemist will make pomades, rouges, and lipsticks far superior to those in current practice. He will devise new creams; also harmless colors for hair.

Difficulties of the Industry

There is hardly a cosmetic house in the country that is not afraid to change sources of supply of certain materials. Why? Because they do not understand fundamental reactions. A slight variation might cause differences for which they would not know how to compensate. The chemist will derive criteria on which to base value of materials so that in many cases cheaper and better materials may be utilized at a saving.

With this large field before him, what is the chemist to do? In the first place, there are few places where he can learn the mechanics of cosmetic manufacture, although the fundamental chemistry is taught at any of the better schools. The cosmetic industry is peculiar in one respect. When a cosmetic concern wants a chemist, it requires one who can make cosmetics. If upon graduation a chemist applies to a steel company for a job, he is not expected to make steel. He will be put into an analytical laboratory. Within a few days or weeks he can carry on with their methods and gradually acquire knowledge that will some day

get him into the works. But the cosmetic industry as today constituted has but little demand (although the need may be there) for analytical chemists. The chemist must be able to make creams, powders, etc., when he enters, or at least know enough about them to be of some help. Improvements can come later.

Training for the Cosmetic Chemist

Most of the progress in teaching cosmetic chemistry has been made in pharmaceutical schools, as most of the operations are kindred to pharmaceutical processes. Many of the "chemists" in cosmetics are really pharmacists. Possibly a modified pharmacy training following a regular course will come nearer filling the fundamental requirements than any other instruction now available.

Apart from good grounding in chemistry in all branches, particularly physical and colloidal, as well as engineering, the cosmetic chemist should have an extensive knowledge of materials. In particular he should know properties of those items which ordinarily are not stressed in usual chemical courses—waxes, gums, fats, lakes, mineral oils, etc. If he should be fortunate enough to have a sense of odor above the average it will come in handy. A developed artistic sense will also contribute to his advancement. As the cosmetic art and science advance, there will be very few sciences that will not be helpful. If, with all of the above, the chemist can learn something about dermatology and bacteriology, he will have prepared himself for a possibly poor present and an excellent future.

Future of Chemist in Cosmetics

Just what is the present status of the chemist in cosmetics? Apart from the chemists in some of the larger houses it is nothing to brag about financially. Perhaps this too should be modified, since so few of the so-called chemists are real chemists. But the fact is that most of the "chemists" draw from $30 to $50 per week. It is very probable that this is all they are worth. A chemist capable of controlling and originating would probably receive as much as equivalent talent in any other industry; indeed it is likely that he would obtain more than average, due to the fact that the field of good cosmetic chemists is far from crowded. His best opportunity should be with some medium-sized concern; in the largest concerns the changes are slight for advancement, in the small ones (unless exceptional) the volume so small that regardless of value of

Courtesy Givaudan-Delawanna Company

INTERIOR OF PERFUME PLANT

services the chemist cannot be properly rewarded. The small house, however, should provide excellent training grounds.

Unquestionably cosmetics will adopt the chemist; but the biggest rewards will go to him who sells himself to an industry that is almost unconscious of its need of him. The future cosmetic house will have a staff of scientists, a chemist, dermatologist, bacteriologist, and others. Within a decade many of the materials now employed will be discarded. Chemicals will be employed that are today mere laboratory curiosities. The chemist will find thousands of compounds for the purpose where only a couple of hundred are used today.

Opportunities for cosmetic research exist outside of employment in the industry. Peculiarly enough the greatest needs of today both concern the hair. There are fortunes to be made either by preparations to take it off or put it on. Harmless hair colors are wanted. As long as men admire women (and vice versa) there is work to be done in beautifying materials—cosmetics.

The Chemist and Stock-poisoning Plants

By James Fitton Couch

A chemist from the Bureau of Animal Industry describes the pioneer work being done by chemists in protecting the herds of the Western plains.

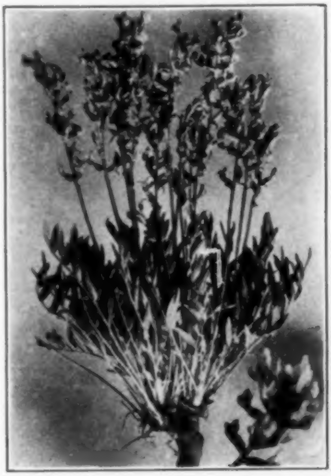
IT IS estimated that livestock producers whose herds graze on the great ranges of the western states lose from 3 to 5 per cent of their stock yearly through plant poisoning. Losses of sheep in Wyoming are said to exceed 14 per cent, and the total financial loss for all livestock in Colorado was estimated in some years at a million dollars. Isolated instances occur frequently of disastrous losses to individuals in which the greater part of a herd or flock may be fatally poisoned or rendered unmarketable through grazing on some deleterious weed.

A large portion of this loss is preventable; and the Department of Agriculture early took steps to remedy the situation. A force of experts was assigned the task of investigating the conditions—determining what plants were causing the trouble, studying the circumstances under which poisoning occurs, and suggesting measures to avoid it. The first leader of the project was V. K. Chesnut, who was trained both in chemistry and botany. Since his time chemical information concerning these poisonous plants has been regarded as of great importance.

When the investigations were begun, very little was definitely known about stock-poisoning plants. A few had been recognized by the stockmen to be dangerous, but some that were suspected have since been proved harmless. Contradictory ideas were to be met with on every hand, while quite obviously improbable statements were implicitly

believed by many stock owners. A few of the poisonous native plants are related to well-known toxic European species and could be suspected, *a priori*, but the greater portion were not recognized as dangerous and had to be studied in detail to determine their toxic properties.

A number of factors combined to complicate the investigations and to make it difficult to draw correct conclusions. Much depends upon the abundance of good forage plants on the ranges. In general, animals will not consume large amounts of poisonous plants unless they are driven by hunger. This is not always true, for poisonous plants are not always unpalatable. Animals exhibit little protective instinct against eating them. In ranges that have been over-grazed there is great danger that poisonous plants will spread more rapidly than good pasture grasses, and the weeds may even take possession of the greater part of grazing area. Under such conditions poisoning follows almost as a matter of course. In other cases a poisonous plant that has been unimportant because it has not been growing in quantities large enough to cause poisoning may suddenly find exceptionally favorable conditions of climate, soil, rainfall, or a combination of these, and may proliferate so rapidly that it shortly assumes a prominent position among the toxic vegetation. An instance of this kind occurred fifteen years ago when the whorled milkweed (*Asclepias galiodes*) spreading through the irrigation ditches took possession of abandoned orchards and increased so quickly that a number of serious losses occurred before stockmen could be warned against the plant.



WHITE LOCO WEED

Variation at Different Seasons

Certain plants are dangerous only or mainly at certain seasons. Losses from the water hemlocks are confined almost wholly to the spring months when the abundant moisture softens the ground and permits animals to pull up the roots of the plant and eat them. Larkspur is

dangerous during the summer months but causes no trouble after it has gone to seed. Lupines are usually more dangerous when the seeds are well formed; but some species appear to be capable of poisoning animals throughout their vegetative period. In other cases, poisoning occurs during the later summer and fall, when the pasture grasses have been eaten off and little but poisonous weeds remains for hungry animals to eat. Climatic conditions play an important part, especially with the large group of cyanogenetic plants that become very dangerous following periods of drought or after an early frost.

LARKSPUR, *Delphinium barbeyi*

In determining whether a given plant is poisonous and whether there is a seasonal variation in toxicity, the chemical evidence is of value. The isolation from plant material of some definite chemical compound capable of reproducing the type of poisoning caused by the plant is final proof that the plant itself is poisonous and that the symptoms are not due to bacteria, molds, or other local or accidental factors. A study of the chemical character of the toxic compound suggests possible remedies and also offers a means for testing specimens of the plant from various regions to determine whether there is a variation in toxicity under differing growing conditions.

Interesting Chemical Problems

The chemical problems that arise cover a wide and extremely interesting field. In a few cases the poisonous compounds prove to be well-known substances like nicotine, oxalic acid, hydrocyanic acid, conine, or cytisine. Usually however, the responsible agent is wholly new to chemistry. The chemist is required not only to isolate it from the plant but to purify it and determine its chemical character. When it is remembered that at least a hundred poisonous plants still await chemical study and classification in spite of the intensive researches conducted by the Federal Government and the State Experiment Stations and that new poisonous plants are continually being discovered, some idea of the magnitude of the chemist's task may be obtained.

The results already obtained and the mass of information available are too extensive even for a superficial discussion within the limits of a moderately long article. It seems preferable to select a few representative plants and to discuss them briefly in the hope that the description will convey some idea of the chemically interesting aspects of poisonous plant investigations.

The Famous Loco Weed

The title "big-shot" of all poisonous plants would probably be unanimously conferred on loco weed. Indeed, at one time the word "loco" was used synonymously with "poisonous" to describe dangerous plants. However, the term is now restricted to a number of species of *Astragalus* and *Oxytropis* which cause similar and very characteristic symptoms in livestock. Animals poisoned by prolonged feeding on these plants are termed "locoed" because they act in what is considered a crazy fashion. Loco was the first important plant-poisoning condition distinguished in the old West. It early was made the subject of extensive investigation, and a number of very competent chemists have during the past fifty years attempted to isolate and study the active principle. Up to the present time, however, this compound is almost as mysterious as the enzymes. Our researches have furnished us a great deal of information concerning it and have obtained it nearly pure but not crystalline. So far as our information goes, this substance does not belong in any of the well-recognized classes of poisons, being neither alkaloid nor glucoside, acid, ester, or mineral. It contains nitrogen but is not basic, while the large proportion of oxygen in the molecule suggests that it is highly hydroxylated and may be ultimately derived from the carbohydrates. This substance is as hygroscopic as phosphorus pentoxide. So far it has been isolated from *Oxytropis lambertii*, the white loco. Other species of loco are under investigation to determine whether this constituent is also present in them.

Species of larkspur, *Delphinium*, cause a great deal of loss every year. The chemical study of these plants has been undertaken by O. A. Beath, of Wyoming, who found that the active principles are complex alkaloids different from those already isolated from the European species.

A Family with Bad and Good Members

That delightful relative of the sweet-pea, the lupine is found growing almost everywhere west of the Mississippi river. The botanists tell me that there are some 150 species already determined from that region; and Ivar Tidestrom in his *Flora of Utah and Nevada* lists 53 species from

A Lupine, *Lupinus sericeus*

White Snakeroot

those two states alone. The lupine compares favorably with alfalfa, clover, and other legumes in nutritive value. It will grow thickly on poor soil and would be a valuable forage plant were it not for the poisoning that lupines sometimes cause. Certain of the lupines are dangerous to livestock, others are less harmful. Some may be non-poisonous under range conditions and so be very fine stock feed. Many of the stockmen regard the lupine as good feed and allow their herds to graze it without stint. It is, therefore, of great importance that information be obtained to enable the stockmen to distinguish the very poisonous from the less dangerous species. The chemists can be of great assistance in this direction.

The active principles of the lupines are alkaloids, peculiar in that many of them are liquids, few are strong bases. They are quite soluble in water, and their salts hydrolyze in aqueous solution. They are quickly eliminated from the animal body, so that unless a toxic dose is obtained rapidly, an animal may eat lupines for a considerable time without suffering poisoning. Since the alkaloids are concentrated in the seeds, the plants are more dangerous when in pod, especially since the soft green tissues of the immature legume are attractive to range animals, which do not seem to dislike the very bitter taste that accompanies them.

Stimulated by a particularly bad outbreak of lupine poisoning in Germany in 1872, there were many chemical examinations made of the

lupines commonly grown in Europe. Among other results four alkaloids were isolated, sparteine, lupinine, lupanine, and hydroxylupanine, the last three new to science. It was naturally supposed that the American lupines would contain mixtures of these alkaloids. The early studies made here assumed this idea. However, after much work in this field, sparteine and lupinine have been found only in one single species of lupine and that a European species, *Lupinus luteus*. Lupanine has been found in two American species and hydroxylupanine in one. The alkaloids isolated from other American species so far as they have been studied appear to belong to the same general series as the European alkaloids but to be new compounds not hitherto described.

RAYLESS GOLDENROD, CAUSE OF TREMBLES

These alkaloids differ considerably in toxicity. Lupanine is the most toxic of those determined and hydroxylupanine the least toxic. On this account a mere determination of the total amount of alkaloids in a species of lupine is no index of its power to produce poisoning. It is necessary to separate the alkaloids and to determine the chemical properties of each before a conclusion can be drawn. This fact necessitates a great deal of careful chemical research combined with actual determinations of the toxicity of the pure alkaloids when obtained.

Chemistry Solves Century-old Mystery

A very interesting chemical problem arose in connection with the study of that peculiar disease of the Middle West known as milksickness when it attacks human beings and termed "trembles" with respect to livestock. The etiology of this disease was a mystery for nearly a century. Those who studied it advanced opposing opinions, so that the whole subject was involved in controversy at the beginning of the present century. Bacteria, mineral poisons, plants, molds, mushrooms, and contaminated water supplies were all advanced at one time or another as causes.

Interest in the poisonous-plant hypothesis was revived by E. L. Mosely of Sandusky, Ohio, who reported the result of some experiments made with white snakeroot (*Eupatorium urticaefolium*) in which he described cases of poisoning with the plant or with extracts made from it. Further work demonstrated that this plant was capable of poisoning

animals and that the symptoms exhibited by the sick beasts were identical with those reported from spontaneous cases of trembles. It was also shown that the milk of cows and sheep suffering from *Eupatorium* poisoning could communicate the disease to other animals. While these investigations were in progress, it was discovered that a similar disease occurs in the Southwestern states, where white snakeroot does not grow. In this case a different plant, rayless goldenrod, was incriminated.

New Poison Discovered

Chemical investigations had been conducted with material from both plants but nothing definitely poisonous had been isolated; and this lack of a specific toxic chemical compound was a serious defect in the chain of evidence linking either of these plants with the disease. New studies conducted in the light of more knowledge about the plants resulted in the final isolation of a very labile substance, difficult to purify without decomposition, which was capable of reproducing the disease in animals. This compound, tremetol, is an oily liquid, chemically classed as an alcohol. It was first found in white snakeroot and later in two species of *Aplopappus*, one the rayless goldenrod, and the other a closely related plant. Tremetol has not been found elsewhere in nature.

The subject of cyanogenetic plants is of perennial chemical interest. Although a great deal of information has been accumulated concerning this group there still remains much to be done. Cyanogenetic plants like wild cherry contain glucosides that split off hydrocyanic acid when in contact with certain enzymes usually found in the same plants but normally stored in separate tissues. When the growth of the plant is interfered with in any way there is a rapid mixing of enzyme and glucoside with resulting formation of hydrocyanic acid. Cutting, frosting, wilting, trampling, or stunting the plant by drought all result in this phenomenon. Plants that contain readily formed hydrocyanic acid are very dangerous to livestock even when the normal plant is, under practical conditions, not harmful. Many cases of poisoning from this source occur every year.

Need Still Better Chemical Methods

We are particularly in need of some reliable rapid method for the determination of hydrocyanic acid in plant tissues, either as ready formed acid or as glucoside. We need information concerning the variation of hydrocyanic acid content of these plants under differing climatic, seasonal, and soil conditions and at different stages of growth. Much of this information is available as the result of the researches of a

number of chemists who have applied themselves to the problem; but much more is needed. We need knowledge of the rate at which hydrocyanic acid disappears from these plants when they are made into hay and why certain of these hays, although they retain much of the glucoside, do not liberate hydrocyanic acid to cause poisoning.

Other chemical problems revolve about the milkweeds and the death camas, about species of Daubentonia, Karwinsika, Bikukulla, the Ericaceae, Baccharis, Xylorrhiza, and Senecio to mention only a few. Comparatively little has been published about most of these, but they present questions of great interest not only to the chemist but to the toxicologist, range manager, and livestock producer as well.

The adage that an ounce of prevention is worth a pound of cure is applicable to the stock-poisoning plant situation. But we must first determine which plants are poisonous and under what conditions poisoning occurs. This is distinctly a problem for the chemist.

Stabilizing a Profession

By J. N. Taylor

A government chemist discusses the importance of economic guidance of research effort. Science scientifically directed.

WE HAVE recently heard a great deal about technological unemployment. Some of our profession have experienced it. Directly or indirectly everyone has felt its effects. Fortunately, however, the chemist has escaped much of the present depression, chemical industry having continued its research and forward program in anticipation of better times to come.

To what extent the present unsettled economic situation has been caused by the creative efforts of chemists and of other scientists is

difficult to state. One is unable to say in what degree the chemist has been responsible for bringing about "an embarrassment of riches." Concannon and Delahanty[1] in discussing intercommodity competition have, however, given us an insight into this situation and of some of its results.

Obsoletion and over production may, perhaps, be caused by lack of complete correlation between chemical research and distribution methods. This statement is not to be interpreted as intimating that research should wait upon demand, for fundamental research, of course, must go on. Chemistry, while engaging in an industrial cooperative program, must not neglect pure science. The question arises, then: How much of an interest should the chemist evidence in general economics? How far should he concern himself with specific economic problems of the day? Surely, the average chemist should be sufficiently interested in them to be able to discuss in an intelligent manner the signs of the times.

As previously pointed out by the writer[2] and by Moraw,[3] this need for a more intensive knowledge of economic conditions as they affect the chemical industry has already evolved a new kind of chemist, one possessing both chemical and commercial training. But a beginning only has been made in this direction. Every worker in the vineyard should give some time and thought to the interrelationship of science and business. More trained chemist-economists should be in the councils of industry's planning boards. True, the present-day worker has little to say in planning industrial projects, but this is because few matters are decided by the haphazard will of the individual. As observed by Weidlein and Hamor,[4] industrial organization is devised to reduce waste and losses caused by mediocrity and is not contrived to prevent or hinder expansion of ability. Hence, it is imperative that those of our profession who direct the efforts of research chemists and of control chemists should be able to recognize current movements when they see them and to have an awareness of what present progress presages for the future. Laboratory and plant directors must know definitely what researches to pursue, what projects to initiate, and what discoveries to apply or to hold in abeyance. Scientific management, as Bass[5] has pointed out, is vitally important and must have available dependable economic surveys of the

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[1] Concannon, C. C., and Delahanty, T. W., "Intercommodity Competition," *Chemical & Metallurgical Engineering*, **38**, 10 (1931).

[2] Taylor, J. N., "The Commerce of Chemistry," *Science*, **72**, 153 (1930).

[3] Moraw, H. O., "Chemical Economics," *Chemical Markets*, **26**, 380 (1930).

[4] Weidlein, E. R. and Hamor, W. A., "Industrial Research, Machines, and Labor," *Pittsburgh Record*, University of Pittsburgh (1931).

industries. Means of insuring for the chemist stability of employment and continuity of effort through adjustment of production to consumption may well be approached through the avenue of merchandising research. A set-up composed of chemist-economists operating in the domain of economics in a manner analogous to the referee work carried on by the Association of Official Agricultural Chemists in the field of chemistry would in a few years be productive of wonderful results.

In this connection the meetings recently held in New York, Washington, and several other large cities looking toward the formation of the American Marketing Society are of especial significance. The object of the Society, as stated in its provisional constitution, is "the advancement of science in marketing by providing for the systematic study and discussion of marketing problems and the formulation of standards or principles in this field." Chemists eligible for membership should by all means seek affiliation with this organization.

After all is said and done, an outstanding service the chemists can render his profession is through the solution of problems lying broadly in the field of distribution.

C. C. Concannon, F.A.I.C., Chief of the Chemical Division of the Department of Commerce at Washington, who has been actively engaged for many years in the field of economic chemistry, is in a position to give further information regarding this movement to those interested.

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[6] Bass, Lawrence, W. (*a*) "Annual Survey of American Chemistry," National Research Council, 1931. (*b*) "How the Chemical Product Differs Economically," *Chemical and Metallurgical Engineering*, **37** (1930).

Economic Research for the Chemist

By David P. Morgan, Jr.

A chemical economist suggests a major aim on which The American Institute of Chemists might wisely concentrate its efforts. Investment thinking applied to a profession.

THOSE who were present at the October meeting of The American Institute of Chemists heard an interesting and heated argument between certain disputatious members. One speaker made a stirring appeal for the Institute to select a single objective on which to concentrate its efforts in the cause of the struggling chemist.

It was argued that another society with somewhat similar aims in a related field had gained renown by centering its attention principally on the single objective of improving the technical training given in post-graduate courses. It was implied that The American Institute of Chemists could improve its service to the chemist by singling out one problem of general interest on which to focus all its energies.

The criticism was made that the Institute is tackling so many problems that its efforts have been spread out too thin to be markedly effective in any one field. This allusion was fortified by analogy to the ineffectiveness of the hunter who shoots at random into a covey of birds instead of aiming at one at a time.

That it is dangerous to rely on analogies was brought out by another speaker, who suggested that if a whole group of expert marksmen, *e. g.*, the Institute, were to blaze away at a single bird there would be little or nothing left of it. The point is well taken, but is that constructive criticism?

Without intending to disparage the laudable efforts of the Institute in the numerous fields in which it has been active, it is hoped that the following discussion will arouse interest in a single goal which is worthy

of achievement. Also, while the objective about to be described is not entirely beyond the range of the Institute's big guns, it is not such an easy mark that it will be demolished in the first broadside.

Chemical Training an Investment

Everyone will agree that a well-trained chemist has made a substantial investment, both in time and money, in his art. Obviously, the money expended and the years devoted to specialization are justified only if a satisfactory yield is obtained. In many cases the investment is successful. In other cases, however, the returns are disappointing. It is our belief that in many of the latter cases the distressing results are needless. A proper evaluation of the risks involved, based on a business-like study of the economic situation, would probably have indicated that the chance of a satisfactory return on the chemist's investment was disproportionately small in view of the hazards to be encountered.

Nowadays progressive chemical corporations make appropriations for commercial research just as they do for technical research. It is pretty generally recognized that measurable economic factors play a vital rôle in the outcome of chemical enterprises. To obtain adequate information is costly, but the expense is not spared.

Similarly, up-to-date investors in securities insist on having more and more knowledge regarding the economic characteristics of the industries in which they participate. To distribute the expense of obtaining adequate information, many of them combine in employing the services of organizations which make a specialty of this type of work.

Chemist Lack Economic Information

What does the average chemist know about the basic economic and financial forces which govern the yield he is to obtain on his investment? True, the vast funds of information disseminated by the government and by the trade publications are available to him, but how can anyone single-handed hope to digest the volumes of material that come out each week? What applies to experienced men holds even more forcibly for students. To them all branches of chemistry seem destined to open into vistas of golden opportunity.

In boom times many of these happy dreams come true. We all know men who have ridden to prosperity in such lines as rayon, synthetic resins, lacquers, and so on. But at the same time we also know equally able and industrious men who have been less fortunate for no other reason than that the field in which they specialized was in some way economically unsound.

A case in point is the low-temperature carbonization of coal, a field in which many chemists have done excellent work. For this enterprise to be successful it was essential that satisfactory credits should be obtained for certain by-products of the operation. When adequate markets for these products were not forthcoming, the project folded up. In consequence a number of chemists were let go.

These men speculated and lost. It would be interesting to know if the risk they took would have been compensated for by an adequate return had the enterprise been successful. No careful investor would consider putting more than a very small portion of his funds in any one speculative proposition. Consequently he would not be embarrassed by a 100% loss. And if the project were a success he would expect a very handsome yield on his commitments. To what extent do these considerations apply to the chemist?

A Solution of the Problem

It is the object of this article to contend that this sort of economic waste is to some extent needless. To be sure, "nature is wasteful." Progress is slow and expensive. But is it not possible for the members of the Institute to help each other to eliminate some of this waste where they are concerned by pooling their resources of experience and knowledge in these matters?

One concrete thing that could be done for a starter would be to undertake a series of studies, from an economic point of view, of outstanding chemical enterprises both prosperous and defunct. The stories could be published in *The* CHEMIST and discussed at our meetings. It should be interesting both to readers and writers to examine familiar industries from a different point of view. There is nothing startlingly new about this suggestion. *Fortune* has been conducting a series of articles of this nature, several of which concerned chemical enterprises. *The* CHEMIST would favor a little more data in place of description and romance. And a great deal more emphasis could be placed on the opportunities for chemically trained men.

To sum up, it has been suggested that the Institute urge its members to contribute a series of economic surveys of the various industries in which chemists are interested. The object of these studies would be to make available useful information regarding the more important factors that may determine the success or failure of chemical enterprises.

Chemistry and the Telephone

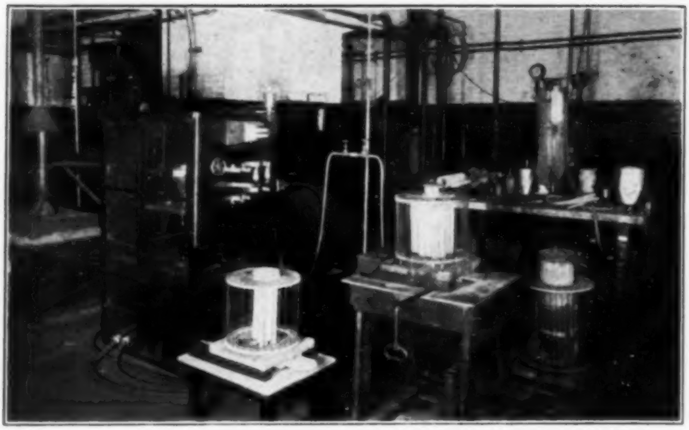
By R. R. Williams

The head of research of the Bell Company describes the part that chemistry plays in the greatest public utility.

WERE one to follow a telephone message along the wires from speaker to listener, he would encounter a surprising list of materials. From a die-cast mounting, finished with lacquer, he would lift a handset of phenol plastic. Presently his voice would impinge on a duralumin diaphragm, setting into vibration several thousand carbon granules imprisoned in a gold-plated chamber. Variations in the electric current from a lead-plate storage battery would pass over copper wires, insulated with paper and enclosed in a lead-alloy sheath.

Although the list might be extended indefinitely, its size would not necessarily indicate the importance of materials to the telephone industry. Such factors as long life, frequently of the order of fifteen years; extreme lightness of certain parts; electrical efficiency to conserve the feeble speech currents; and great reliability are all essential in rendering dependable telephone service at the lowest cost. Knowledge of the chemical properties and structure of materials has long been a recognized field of inquiry in telephone research. A group of some 150 chemists and laboratory workers is continuously engaged in such studies in Bell Telephone Laboratories.

Under the research director are J. E. Harris, in charge of metallurgy, A. R. Kemp, in charge of organic chemistry, and R. M. Burns, in charge of electrochemistry, analyses, and the chemistry of finishes. In addition, we have groups engaged in physico-chemical research and in special studies.



INDUCTION FURNACES

One of the interests of the metallurgical group is the production in varied forms of special magnetic materials, illustrated by permalloy and perminvar. A particular case in point is that of the production of brittle forms of such special magnetic materials, the object being to permit the grinding of the metal into a coarse dust. The dust particles are then insulated by deposition of a film on their surfaces and are pressed into rings which form the cores of modified Pupin-type loading coils. This unusual objective of rendering metal brittle has been achieved in general by the principle of introducing an impurity into the melt, which has a tendency to segregate at the grain boundaries, thus facilitating subsequent fracture. Each alloy requires some special consideration, both as to choice of embrittling agent and heat treatment and working schedules for development of proper grain size.

Scarcely any metallic material has given the telephone industry more concern than the lead alloy used for cable sheath. Pure lead is too soft for the purpose and can be too easily damaged mechanically. Years ago about 3 per cent of tin was alloyed with the lead as a hardening agent. Tin was later superseded by 1 per cent of antimony, primarily for reasons of economy. It has been reported that twenty million dollars have been saved to the telephone system by this substitution alone.

The use of these hardening agents affords an example of the dispersion hardening of metals, which has become familiar to the public most

conspicuously in the case of duralumin. It is the belief of metallurgists that the introduction into a molten metal of a constituent which is precipitated out in very finely divided form upon cooling the metal diminishes the deformability of the finished material by interposing itself in the slip planes among the atoms of the metal.

Hardening Agents Lose Effectiveness

Dispersion hardening in a metal as soft as lead represents a rather extreme case, for lead at atmospheric temperatures is approximately as deformable as steel at dull red heat. It has been found that the antimony used as a hardening agent in lead cable sheath tends, especially under the influence of repeated flexings, such as those due to thermal expansion, to redissolve in the metal and redeposit elsewhere. In this fashion large particles of the antimony grow at the expense of small particles. The hard-worked portion of the metal is eventually deprived of antimony content and fracture occurs.

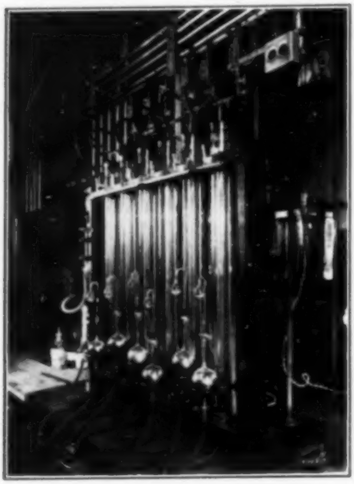
This has been the source of considerable trouble in aerial cables, especially at the bends which occur at the poles due to expansion. The working out of this problem in fatigue of metals has been a long process, but promises to bear further fruit in the development of better hardening agents. One of these, a joint development with the Western Electric Company and one which still remains to be tested on a commercial scale, is calcium, which in the minute proportion of 0.04 per cent has been found in laboratory experiments to produce a hardening well surpassing that of 1 per cent of antimony.

Another interesting metallurgical problem is that of solders for use in wiping joints in telephone cables. Somewhat to our surprise, it was found that some of the supposed prejudices of workmen responsible for cable splicing were well founded, and that it is scarcely practicable to make a satisfactory wiped joint with a lead-tin solder containing less than 38 per cent or more than 42 per cent of tin. New solders may well grow out of this study of why and how the old-fashioned solder works.

Other Metals Also Important

The interests of the telephone system extend of course to many other metallic materials, notably iron and steel, brasses and bronzes, die-casting alloys, etc. For the most part, however, progress in these fields has been along the lines of that of other industries. Part of the metallurgical shops are largely devoted to the melting, casting, and fabrication of a great variety of alloys into wire rods or sheets of specified dimensions for experimental trials in electrical apparatus design.

Parallel with a study of the theory of dielectric behavior, a number of more immediately practical dielectric problems are being prosecuted, the majority of them under the direction of A. R. Kemp. One of these relates to the use of rubber and gutta-percha in submarine insulation. The latter is the classical material for this purpose, while rubber has been regarded as an inferior substitute. The supremacy of gutta-percha is due in part to its mechanical characteristic of thermoplasticity, which permits it to be extruded as a continuous insulating layer about a conductor, requiring nothing but the simple process of cooling to convert it into a tough, firm sheath. An even more peculiar virtue of gutta-percha is the stability of its electrical characteristics during prolonged immersion by water. By patient experiments extending over several years, it has been demonstrated that the inferiority of rubber in this one respect is due wholly to its non-hydrocarbon constituents. Methods for the elimination of these foreign substances, notably water-soluble salts, proteins, and quebrachitol, have required extended study.



MEASURING GAS ABSORPTION

A development of primary importance in this connection has been the elimination of the proteins from rubber. It appears that the protein constituents form an intricate network which permeates the entire mass. While the amount of proteins present is too small to cause a large absorption of water, they do insure by extending the water-bearing filaments throughout the material that such water as is absorbed causes a maximum electrical damage. The partial hydrolysis of the proteins and the thorough coagulation of any remaining residues by autoclaving the rubber under steam pressure has afforded a simple but effective means of stabilizing the material electrically against the action of water.

Rubber for wire insulation must offer resistance to cutting of the wire through the insulation under severe load, such as is produced by a deposit of sleet. Our chemists have therefore been called upon to contribute to the development of a compression-testing machine for

rubber which automatically plots the reduction of thickness of wall under an increasing compressive load. By the use of this testing machine surprisingly great variations were discovered and corrected in the material supplied by different manufacturers.

Another large field of chemical investigation comes under the general head of electrochemistry, which for convenience includes corrosion, corrosion prevention, and finishes of both metallic and organic (paints, etc.) types. This work, as well as the analytical laboratories, is under the supervision of R. M. Burns.

The corrosion work consists of both corrosion testing and fundamental studies on the mechanism of corrosion processes. The corrosion tests are carried on under normal service conditions and by laboratory-accelerated processes. The results furnish guidance in engineering decisions as to the use of materials. More fundamental investigations in the field of corrosion have to do mainly with the study of the electrochemistry of corrosion reactions, film formation, etc. It is of importance, for instance, in the development of corrosion theory to determine the effect of the environment, and of the passage of small electrical currents, upon the anodic and cathodic behavior of pure metals.

Extruding Cable Sheath

Underground corrosion is an important part of the field. The most striking examples of this phenomenon are found in steel and iron structures and particularly in the lead sheaths of subterranean cables. Stray currents from trolley systems often cause such corrosion, and an elaborate and expensive electrical bonding system is maintained in order to minimize these troubles. The physical and chemical nature of the soils and the underground waters and atmosphere often play an important rôle in determining the kind and extent of corrosion by stray current.

Other occasional cases of electrochemical corrosion have been encountered in which stray current, though present, does not arise from

trolley-line power houses. In one large city it was found that a battery covering a square mile or more of area had been inadvertently created, such that it affected a large part of the cable system in the center of the city. The cinder fills underlying the duct runs in this area contained enough carbon to serve as one electrode, while the iron-pipe systems supplying gas and water to the city furnished the other electrode. The moist soil afforded a conducting path for a galvanic current that wrought a wide-spread damage to telephone cables in the area.

In another and much larger area widespread injury to cables came about through the presence of traces of acetic acid in the air in wooden duct systems. The source of this acid was the wood itself, which happened to be of a rather highly acid variety. The natural acidity of the wood was further increased by the somewhat drastic process of heating which was necessary to secure a fair penetration of the wood with creosote. In so far as the creosote penetrated, the acid produced in heating was neutralized to a great extent by the nitrogenous bases in the creosote. Often, however, the total acid produced far exceeded the neutralizing power of the creosote bases contained in the external shell of creosoted wood. The sheath of many miles of cables underwent a partial conversion into white lead via the classical Dutch process which, though highly regarded by paint manufacturers, became anathema to telephone engineers. The difficulty was met by fumigating the ducts in service with a dilute ammonia-air mixture and by choosing different treatment of wood for future construction.

Trouble Underground with All Metals

Underground corrosion of other metals, notably of iron and steel, is also often serious. In the alkali soils of the Southwest anchor rods for telephone poles have sometimes corroded through in a few months. Marshes represent another severe exposure for iron and steel, as, for example, in the form of loading coil cases. A newly introduced form of telephone cable for direct burial in the soil demands careful consideration from this standpoint. A variety of protective finishes, chiefly of asphaltic or pitchy nature, have been studied in this connection. Some remarkable cases have been noted, in which a finish that proved to have a superior protective effect in one highly corrosive soil was worse than useless in another soil which had been regarded as less corrosive in the general sense.

In the physico-chemical research group, two important investigations have been concerned with the insulating properties of textiles and of paper. It has now been quite clearly shown that textile fibers serve as

CARBON ANALYSIS LABORATORY

filaments upon which the moisture of the atmosphere is deposited, and that the electrical characteristics of the textiles are determined largely by the thickness and continuity of these water films and the conductivity of the solutions formed by contact with the textiles. The presence of water-soluble impurities in textile insulations is therefore very important. Their thorough removal by controlled processes of washing has resulted in vast improvement in both cotton and silk.

For some reason not yet fully understood, silk is much superior to cotton as an insulating material over the usual range of atmospheric humidities. This is true in spite of the fact that cotton absorbs less water than silk at a given humidity, and that, over the usual range of use, silk is more sensitive electrically to a given increment of water than cotton. This is responsible for the extensive use of silk in the electrical industry at several dollars per pound. The purification of cotton, however, has made it good enough to replace silk for a large number of purposes, especially in telephone cords. The saving thus effected amounts to several hundred thousand dollars per year for the Bell system. In addition to this practical result, such studies as these have suggested interesting scientific possibilities in the use of electrical measurements for determining the structures of colloids.

An allied product is paper, which is used in enormous quantities in the construction of the common type of telephone cable. This cable

consists of a bundle of wires individually insulated from one another by strips of paper helically served about each. Before being enclosed in a lead sheath the bundles of insulated wires are thoroughly dried and thereafter throughout their use have to be protected from entrance of atmospheric moisture by hermetically sealing the lead covering. The functioning of the cables depends absolutely upon the maintenance of an extremely dry atmosphere within the cable. The chemists have been called upon for elaborate studies of the effects of minute increments of moisture upon the insulating qualities of paper and the effect of temperature upon the electrical characteristics of paper containing various small proportions of moisture. Incident to this task it has been necessary to develop a humidity recorder sensitive to as little as 10 parts per million of water vapor in the air. Such a commercial recorder, produced by Leeds and Northrup at our instance, is in successful use as a guide in controlling the atmosphere of cable-drying ovens. Improved devices for determining the brittleness of cable paper and for judging its predisposition to lose flexibility upon baking have also received attention.

Peculiar Properties Sometimes Required

Still another dielectric problem is that of condensers, which are unique in that an insulator of maximum dielectric constant is required, whereas in most electrical apparatus a minimum dielectric constant is sought. For the sake of economy the usual telephone condenser is made of alternate strips of paper and tinfoil which are wound up into a compact roll, and after drying is impregnated with some form of waxy material to bring the capacity to a maximum and prevent subsequent variations with changes of atmospheric humidity. The complexity of the effects of the choice of the impregnating material upon the electrical characteristics of the condenser is most surprising. It might be supposed that condensers of high insulation resistance would also have a high breakdown strength, but this is by no means always the case. It has become evident that the nature of the interface between the individual fibers of the paper and the surrounding waxy material is of vital importance.

It is evident, then, that chemistry plays a large part in what seems at first glance an electrical industry. Chemists and chemical research are constantly improving telephone service and safeguarding the installations now in place.

CONTEMPORARY THOUGHTS

Recognition

An Editorial from *Canadian Chemistry and Metallurgy*

SPEAKING at the banquet of the American Hospital Association, Rt. Hon. R. B. Bennett declared his belief that "the chemist will be an important agent in the curative efforts of man." The Prime Minister recalled that during the King's serious illness a chemist had found calcium deficiency in his blood and had made possible steps to supply this deficiency. "We have not yet solved the problem of how we may have a clear understanding of the content of the blood stream," said Mr. Bennett. "Our analyses have not shown us yet clearly what is required there to meet a condition of disease. It will be possible one day to determine what is needed and to supply the deficiency."

This speech, coming as it does from such an important source, carries with it significant indications from the point of view of the chemist. For years chemists have been feeling that a greater knowledge and understanding of their work by the general public was desirable, and they have been trying to achieve a position in the public eye where their importance in the scheme of things would be better appreciated. In the recent past, several events have shown that these efforts have not been altogether in vain.

For some time, business men and government authorities have realized the part chemistry has played, and has still to play, in the development of our national resources and in their full and efficient utilization. The formation of the National Research Council and of the Ontario Research Foundation are indications of this knowledge on the part of governments and of the industries. This, in turn, has caused the public to appreciate something of the importance of chemistry and the chemist in these fields.

But the chemist is necessary not only in the economic struggle. He is also an integral part of the armies waging the battle against disease. Since the days of Pasteur, himself a chemist, chemistry has played an ever-increasing part in the development of medical research. Specific chemotherapy has engaged the attention of the best brains of our time, and the present trend lies strongly in that direction. The story of

insulin is too well known, especially in Canada, to need repetition, but the part played by the chemist cannot be over-rated. In such investigations as the development of insulin, Ehrlich's pioneer researches on trypanosomes and Carr's more recent work in England, the closest co-operation must be maintained between the chemist, the physiologist, the pharmacologist, and the clinician if worth-while results are to be obtained. Each one fills an important place in this scheme, and the chemist occupies a key position. This has long been recognized in professional circles, but now it would appear that the layman is coming to realize something of the situation.

Just recognition is what the chemist has been trying to get, and the Prime Minister's speech would seem to indicate that he has in some measure achieved it. But this is no indication that his efforts along these lines in the past can be relaxed in the future. It indicates, rather, what may yet be accomplished by continued, intensive, and concerted educational efforts.

Chemists Worse Off in 1921 than Today

Reprinted from *Chemicals*

CHEMISTS and chemical engineers suffered greater hardships in the depression of 1921 than they are experiencing during the present crisis, according to D. H. Killeffer, manager of the Employment Bureau of the Chemists' Club, 52 East Forty-first Street.

"Firms which dispensed with their research departments ten years ago learned that this was bad business," Mr. Killeffer said. "Many employers profited by this mistake and now they are less willing to cut chemists from the payroll.

"Companies that kept their research men and hired skilled scientists who were discharged by other organizations came out of the last depression on top.

"The others, however, were without the services of men experienced in their particular line of products when business returned to normal. They were likewise a step behind their competitors, who had benefited by the research carried on during the period of slack time.

"In 1921 some of the chemists who found themselves out of work started in business independently. In many instances they were ultimately more successful than their former employers. This is likely to occur again. There are presidents, plant managers, and research

workers who have been victims of the depression and who are now unemployed.

"Such men are capable and efficient. Some of them will join together and find capital. As soon as business takes a definite turn for the better, you will find these groups branching out for themselves. They are free from the disadvantages of a large organization, which is frequently cumbersome and slow-moving. The older firms will meet with strong competition from the new companies which are bound to be born out of periods of unemployment."

Approximately 150 applicants for positions in the chemical profession are registering at the bureau monthly, Mr. Killeffer reported. Work is being found for about ten per cent of this number, while others are being encouraged to carry on individual research along lines in which they have been interested.

The New York bureau receives requests for chemists from all sections of the country. This is especially true in the case of jobs which cannot be readily filled. Mergers have been the greatest contributors to unemployment among the chemists.

One wealthy individual, without knowledge of chemistry but with radical scientific theories, has retained several chemists to carry on his private research.

Among those unemployed members of the profession who have taken up experimentation on ideas of their own is a man residing near New York who formerly made a hobby of photographing bugs and plants through a microscope for the amusement and instruction of his six-year-old child.

Friends viewing the pictures became interested and offered suggestions. He is now engaged in bringing out a book containing these photographs accompanied by explanations which would be of interest to any child of six years.

Another chemist, finding himself out of work, interested a manufacturer in the possibility of coloring brass and similar metals. The latter is now financing the scientist, who is carrying on research at Harvard University.

"Since last May," Mr. Killeffer said, "no large number of applications have arrived at the bureau simultaneously. This indicates that there have been no wholesale reductions in the employment of chemists since that time. Early in the year firms were informing their research departments to take a salary decrease or leave. A number of men gave up their jobs. Now, however, both the men and the companies are acting more sensibly."

The Chemist in Fire Protection

By C. J. Krieger

A discussion of one of the ways in which the chemist protects life and property. The scope of chemical work in this field. A talk delivered before the New York Chapter of the A. I. C.

EXCEPT for departments investigating burglary protection devices and work on casualty items, the entire activity of Underwriters' Laboratories is in the field of fire protection engineering. The work is divided among several engineering departments, one of which is, of course, a department of chemistry. Yet I think it is easy to demonstrate that the chemist or chemical engineer has had his finger in the industrial pie in the case of practically every device, material, or appliance that occupies a place in fire protection work.

Broadly speaking, Underwriters' Laboratories' test work falls into three general classes:

(*a*) Hazards—devices or materials which from their very nature are dangerous, and which the fire protection engineer must consequently safeguard as much as possible.

(*b*) Retardants—that is, devices which retard or prevent the spread of fire.

(*c*) Extinguishers—appliances whose function is to put out a fire.

It would be impossible to discuss in a short talk the many thousands of devices which we examine every year under these three classes; but it is very easy to take random examples from each class—without hunting for them—which plainly show the influence of the chemist.

Let us explore first the field of the so-called miscellaneous hazards. The first example that occurs to me is the gasoline pump, or, as we call them, "discharge devices." At first glance this seems to be simply an

electro-mechanical outfit which performs the useful function of filling the family flivver with gas; but it was a chemist who developed the metals and alloys used as bushings and bearings, and another chemist who learned how to produce the gasoline-resistant packing used in union and other connections. The physical chemist is responsible for the type of glass used in the glass cylinder appearing at the top of these devices; and the counter-check work on these cylinders is done by our chemical department. The very gasoline which the device dispenses is blended and refined under chemical control.

The popular domestic electrical refrigerator, consisting as it does of motors, compressors, etc., is essentially a mechanical device; but it would never have come into being without chemical research on the various liquids which serve as refrigerants. In our own work, the fire hazards and the corrosive and toxic properties of these same refrigerants are of major importance.

The so-called "explosion proof" motor seems to be purely an electrical machine; but the explosive properties of the various industrial gases and dusts surrounding these motors govern the nature of tests which must be made. The study of flame propagation—a distinctly chemical problem—enters into the analysis of each one of them. Hence these motors are tested, not in our electrical department, but in our chemical laboratory. In the wide field of insulated wires and cables—a purely electrical commodity—the chemist is predominant.

Chemists in All Parts of the Work

In the retardant division we find the chemical engineers equally active. Offhand, there seems to be no chemistry involved in a wood-core tin-clad fire door; yet it was the chemist who learned at least some of the facts which make some sorts of wood acceptable for this purpose, while others are not; and the commercial application of the tin coating to the steel, resulting in terne plate, is a distinctly chemical process.

The architect and engineer successfully determined the strength and fire-retardant qualities of cinder-concrete building block; but the chemical laboratory determines the proportion of combustible material, cement, and aggregate which produce these desired qualities. Also, it was the chemist who first developed the idea of saturating paper or rag felt with bituminous materials to produce what is known as prepared roofing material. It must be admitted that the actual fire tests on sample roofs covered with this roofing are outside the province of the chemist; but the performance of these materials is so characteristic that their fire-retarding properties can be fairly safely predicted on the

basis of a review of the results of a chemical analysis. The fire-resistive safe, which has so often proved its ability to preserve valuable records after being subjected to fire and conflagration conditions, is another example of the result of chemical research. The fabrication of these safes is obviously a mechanical matter; but the choice of the insulating material used between the steel sheets is up to the chemist. I recall that the presence of occluded water, or water as water of crystallization, presented quite a problem in the early stages of our work on safes; the application of heat produced steam, which was broken down by the hot metal of the safe into oxygen and hydrogen; and hydrogen explosions—resulting in ruptured safes—were not uncommon.

Extinguishers Form Largest Field

In the third field—the one broadly classified as extinguishers—the presence of the chemist is even more noticeable. It is certainly evident that the introduction of carbon tetrachloride as an extinguisher was due to the chemist; and the very name "soda-acid" gives the pedigree of that type of first-aid fire appliance. Although some obscure German brew-master is generally credited with the discovery of the value of foam as a blanketing extinguisher for oil fires, the present foam-type extinguisher is almost entirely the product of the expert in colloidal and bacteriological chemistry.

It is probably unnecessary to point out that the chemist engaged in fire-protection work operates quite differently from the usual chemist. He has a different question to answer, and consequently he attacks his problem in an entirely different manner. A few examples will illustrate the point. The fire-protection chemist is not interested to the slightest degree in whether or not a cleaning fluid will take spots out of a lady's silk gloves; it can ruin the gloves altogether, so far as he is concerned. But he is interested in its flash point, its ignition point, its rate of evaporation, its liability to spontaneous ignition, and any other characteristics which will enable him to determine its fire hazard, in storage or in use. A fire-protection chemist doesn't care whether an insecticide kills bugs or not; but he is vitally interested in finding out about the extent to which it may produce hazardous or toxic fumes while in use.

Have Unique Criterion of Value

Broadly speaking, the commercial utility or excellence of the object under test is unimportant, unless that excellence is directly tied into its value as a fire appliance. The hand chemical extinguisher is an example

of this class. I cannot imagine two laboratories working on the same device with more directly opposite objectives than is the case of our own organization and the technical staff of the Good Housekeeping Institute, for example. We don't care much if a vacuum cleaner cleans your rugs or not; they emphatically do, and will turn down one which does not. There is one point in common, however; the Good Housekeeping people are fully aware of the fact that no appliance is good unless it is safe; and as a result, they supplement their other excellent work with rigid electrical safety requirements which are very similar to our own.

It is hardly necessary to add that this distinct viewpoint is characteristic of all of our engineering work, as well as that which is purely chemical; and hence our test programs, test methods, apparatus, reports, everything—are entirely different from those followed in the usual type of commercial industrial control, or research laboratory.

Chemists Should Expand Usefulness

There is just one more point I would like to touch upon. When Mr. Kenney asked me to prepare this paper, he discussed briefly one of your activities, which is, as I understand it, to educate industry and the public as to the general and varied usefulness of the chemist. This is particularly interesting to me, because there is a somewhat related point that has always puzzled me. My daily work carries me into contact with dozens of widely different industries. With a few exceptions, I find that this state of affairs exists: people take it for granted that the young mechanical engineer gets out of school, spends a probationary period over a drawing board or in the machine shop, and eventually moves on to more advanced duties. Also the civil engineer; he starts out peeping through a transit, and after a while he is building bridges and dams. Why, then, does the popular conception doom the chemist to the eternal companionship of a test-tube and a Bunsen burner? Why is it that nine-tenths of the people we meet regard a chemist as a peculiar sort of a bird who spends all his time in a smelly laboratory "testing things?" He doesn't, you know! I am constantly surprised at how many industries regard the chemist as a sort of expensive overhead, who produces nothing, but who just "tests things." It seems to me that a lot of work needs to be done in correcting this impression; and I know I am correct in stating that this correction would benefit industry as much as the chemist. And if this paper has shown you the importance of the chemist in fire protection, I am very glad of it; for it is a field where he can—and does—render a distinct service.

When You Decide to Go in for Research

By Harden F. Taylor

An executive who reached the presidency of his company by way of the research laboratory looks at the problem from the point of view of the business man and also of the scientist. Excerpts from an article in *Food Industries*.

IT IS the purpose here to discuss some of the problems that confront the proprietor who wishes to institute research and also the troubles of the research man working for a good business man who does not understand the ways of research.

In the larger corporations, these matters give little trouble, for the research department is highly organized under a research director who often is an officer or director of the company. In smaller companies, elaborate organizations are impossible; the president or general manager of the company hires a man, provides him with as much money as he can afford for the purpose, and undertakes to manage him and guide the work in what he thinks is the proper direction. The proprietor may have scant understanding of what research is or how it proceeds to achieve desirable results; accustomed to judging salesmen, accountants, and plant managers, he attempts to judge his research man by similar standards and to use similar methods to get results. What he may actually do is to make results impossible. The good research man often is a curious animal, unresponsive to the tried methods that work with other employees.

It is indeed a difficult thing for a proprietor of a small business and his research man to work harmoniously to the common good. The difficulties arise almost entirely from failure of each to understand the other. Let us examine the two points of view in more detail.

For the purpose of this discussion we must know what we mean by research, for many dissimilar activities bear the name. If goods are not selling as we think they should, we may send a man into the field to conduct market research. He goes behind the counter of a grocery store with pad and pencil and notes what customers call for, and their comments. He sends mimeographed questionnaires to a thousand housewives and makes a number of house-to-house calls. He selects stores in different classes of neighborhoods and determines differences in sales results. These activities are often called market research.

The proprietor, having found that he can successfully direct research in sales and get gratifying results, decides to undertake more elaborate research in the manufacture and improvement of his product, to equip a laboratory, and get a research chemist. He hires his man, perhaps by some accidental method, and judges him by the usual standards. He sets out to plan his research man's work, directs him to get a can opener, open cans, smell, look, taste, and serve test meals for comparison of products, keep records, summarize results, make frequent reports of progress, and draw conclusions. His research man may suggest something more: determination of free fatty acids, sugar content, nitrogen, ash, and other things. Improved recipes may be formulated for better products. Here again, useful information may be obtained, yet this is not what scientists prefer to call research, but rather a species of cookery that often passes for research.

Pitfalls of the Business Executive

As long as the proprietor attempts research along these lines, directing or semi-directing it himself, he invariably runs smack into empiricism, which is the lowest, most expensive, and least productive form of research activity. Empiricism is the trial-and-error method of obtaining knowledge. It is the way one learns by experience, somewhat systematized and accelerated; it achieves progress, but usually by small steps and with the simpler problems. Few outstanding accomplishments result from this procedure.

It is obvious that the layman proprietor could not direct the solution of such problems; not that he lacks the intelligence but because he lacks the background of specialized knowledge. The credit and collections manager of the company may resort to the use of trade acceptances to assure the payment for goods; the chemist could not be expected to protect the company's interests in such matters, not because he lacks the intelligence to do so but because he knows nothing about trade accept-

ances. But, possessed of a broad knowledge of the laws, and the great array of facts of natural science, the chemist, if he is a good one, can see many possibilities of immense value that are utterly invisible to the business man. He can devise new processes and new products, improve the technique, and save money; but there is no possibility that a proprietor, without the apperceptive basis of scientific knowledge, can direct his work.

Various Purposes of Research

From all of this we can reach certain important conclusions about the research man in the industrial scheme of things. Pure scientific research is being conducted in the government laboratories, universities, and endowed institutions all over the world, by thousands of scientists. They are not primarily concerned with profits or even the usefulness of the results of their work. They are discovering what the world is made of, what are the properties of various kinds of matter, how forces act—the relationships and inter-relationships of matter and energy Their results are published in the many scientific journals, and are accumulated in libraries as the growing scientific heritage of man. This is pure research.

Applied research is the use of this body of pure scientific knowledge for practical purposes: new products, better processes, lower costs, and the like. It is the business of the industrial research man to prepare himself in college with the fundamentals of pure scientific knowledge, to keep up continually with current advance in this knowledge, and to apply it to the special problems of the industry he has chosen for his life work.

Method of Choosing a Research Man

If the proprietor wishes to take up research seriously, he must proceed in accordance with these principles. A good man must first be found for the research directorship. First of all, this man must be thoroughly prepared in the fundamentals of science generally and in the special laws of his own field. He must be a habitual and omnivorous reader of scientific books and journals. Such reading keeps him abreast of scientific progress, provides him with new and stimulating ideas, and keeps up his enthusiasm in his work. When he loses this habit, as many researchers do, his usefulness declines. He must be a man of original and creative mind. This quality is a gem and, like other gems, is rare and hard to find, but when found should be preserved. In addition to these fundamental qualifications, he should be a man of good human

attributes, for upon him is likely to fall the duty of directing other researchers if his department grows.

There is no sure rule for finding the man. The possession of a degree from the biggest or most famous university is no guarantee. Dr. Frank B. Jewett, president of the Bell Telephone Laboratories, says that, for young and inexperienced men, the personal recommendation of the professors who had the applicant under their tutelage is the most dependable indication, but even this is not sure. Of course, for older men, capacity, demonstrated by experience, is one of the best signs, but also not sure.

Why are not these sure signs of a good man? Because the circumstances under which a man works have everything to do with his performance. Under the benevolent guidance of a professor and the stimulating surroundings of a university a man may show extraordinary capacity; but when thrown among tough operators in a factory, unappreciative and perhaps jealous plant foremen and salesmen, and driven by supervising business men, his ideals, enthusiasm, and productiveness may be destroyed. Therefore the job is not finished when the man is found. Circumstances must be provided in which his maximum usefulness will manifest itself.

Chief Purpose Is to Create Ideas

Above all, it must be remembered that the duty of the research man is to create and develop ideas. This is a function of the mind. A harried and threatened mind does not generate ideas. Threats and fear are totally useless weapons for driving a research man to produce results. A contented and enthusiastic mind is the soil in which genius grows. Attempts to drive a research man prevent him from producing any results, for, after all, he has to ponder his subject and wait for the ideas to come, and they take their time about coming.

The researcher must be taken into the fullest confidence of the business. He must be given opportunity to know the business he is working for, and his usefulness will be limited if he does not know it. His results must be practical; if he does not know the business itself, he cannot know how to fit his work to it. Therefore, instead of withholding the "private" information of costs, profits, losses, and other intimate facts of the business, the proprietor should insist that the researcher be taught the business as fully as possible.

Involved in this statement are some extremely important considerations that are easily overlooked. A certain natural order guides the march of industrial progress in a definite sequence of events which can-

not be reversed. Flying machines were attempted in classic times by Daedalus and Icarus, and have been attempted throughout the ages; all failures until the proper time for success had arrived. The airplane could not come into being until the internal-explosion engine, volatile fuel, and light alloys were available. Each of these discoveries depended upon antecedent discoveries, without which they themselves could not have been made. The final resulting airplane came to fruition at its natural time, and in its proper place in the sequence of events.

This natural unfolding of the flower of progress is true of every industry. The intelligent and broadly informed manager will keep an eye on it, to know what is next in order. Things attempted out of turn are failures. The duty of determining what is next falls especially on the research man; he must forecast the trend of the business which employs him, for completion of an important piece of research work often takes years. The research man cannot possibly perform this service unless he is broadly cognizant of his company's business. These qualifications plainly call for a man big enough to be eventually an officer or director of the company, or both.

If the proprietor discusses with his research man, on friendly terms, the problems and possibilities of the business, he will not only get new and scientific views of his own business but he will put into his research man's mind the pieces of which great thoughts are made, the ideas which, when combined with those other bits of knowledge obtained from scientific literature, become creative impulses. If the research man cannot receive this confidence without inflation of his ego and without becoming obnoxious to his associates, he is not big enough for his job.

* * *

TO TELL the research man how to do the work for which he has been trained is not our purpose here, but rather to discuss some of the things that may prevent him from doing it.

The first thing the research man needs is the confidence of his employer and his associates—the plant manager, foremen, salesmen, and operators. With this confidence, he can accomplish much; without it he is discouraged and defeated. The research man cannot expect this confidence to be bestowed on him as a matter of course, or because he has a degree or two from a university. Indeed, he is more likely to be looked upon by the general run of employees as the college man with a lot of theories but no practical knowledge, who has a soft job at good pay because he knows a few big words. It is utterly futile to swear at this attitude; it is the natural reaction of men everywhere who have worked

long and hard to get the jobs they have, and who do know their jobs by actual experience.

There is no better or more practical philosophy for the research man than to blame himself for failure for any cause whatever, including even the narrow-mindedness, jealousy, selfishness, and prejudice of others. These are some of the factors that exist in any organization and must be taken into consideration in producing a result. Often they are as important as the chemical reaction involved, design of apparatus, or technique of operation. Human factors are controllable, or can be allowed for, quite as well as temperature. The wise researcher will take into consideration every factor; if he misjudges or misunderstands the human factors, he makes as serious a mistake as if he erred in solving an equation.

Great Importance of Being Clear

Confidence of employers and associates is won by two equally important elements: ability to understand others and to make oneself understood; and the production of useful results. We shall write no homily here on the virtues that makes one liked: tact and kindliness. But something must be said about the researcher making himself understood. The business man and plant operator are not expected to know the professional jargon or shorthand of scientists. They speak and understand the ordinary English language. In this language the researcher must speak to employer in selling his wares. The use of scientific terms for the purpose of making an impression is likely to have an effect quite opposite to what is intended. If they must be used, and are clearly and tactfully explained, it will be found that everybody likes to learn new things and new tricks, and to appropriate them for himself. But for purposes of bombast, they are in bad taste and dangerous. The art of writing or telling about scientific subjects in clear, simple language is a great asset to the individual researcher, indispensable in dealings with the chief and co-workers in the plant.

The business man and the research man may judge a given accomplishment by quite different standards. I have on a few occasions puzzled for days or weeks on the technical aspect of some problem, and finally triumphed with a solution, of which, as an ingenious scientific accomplishment, I felt I had reason to be proud. The chief, to my dismay, showed no interest whatever in it. But when I made some improvement in, say, a package or other trifle, about which I secretly felt a bit scornful as involving no challenge to scientific ability, the chief was profuse in his congratulations. In the one case, the employer had no

way of knowing whether my little scientific triumph was new, or difficult, or clever, and anyway, even if it were all of these, it had no particular significance to the business. But the improved package meant lower cost, or better sales, or more effective competition, and these things he did not fail to appreciate abundantly. His failure to discriminate between the simple and the difficult, between the obvious and the recondite, is sometimes disconcerting but, nevertheless, natural; the research man could as easily fail to perceive genius if the proprietor should conceive an equally novel and ingenious method of financing or selling.

The art of putting oneself in the position of the business employer and seeing things from his point of view is not only desirable but essential. Wasting time and effort on trifling improvements and inventions is the natural consequence of failure to comprehend the business broadly.

The other factor in winning confidence is the production of useful results. However likable and persuasive he may be, the researcher is measured by his works. Ideas must be conceived, criticized, checked, and tested, and then carried through the experimental and development stages into successful operation. Many men are good at one or another of these functions and in larger institutions men specialize in one or another of them. The brilliant man, who is fortunate enough to bubble over with ideas all the time, may easily fail to carry out any of them, because in the course of working out one idea, he gets another new and more fascinating one.

Each Type Has Different Approach

On the other hand, some men are not generators of frequent and brilliant ideas, but are careful, patient, accurate, and persistent in carrying projects through to completion. It is a mere platitude to say that one idea completed and put to work is better than any number, however brilliant, not worked out. This paper is no place to discuss the old question as to whether imaginativeness or creativeness is an inborn talent. The present writer has always believed that it is merely a mental habit, that can be cultivated, of fitting together, like the blocks of a jigsaw puzzle, the concepts that are obtained from reading scientific and technical literature, the bits of knowledge that come from observations in the plant or laboratory, or from stimulating conversations with other people. If one's mind is engaged during all otherwise idle moments, in fitting these concepts and bits of information into all possible combinations, new and often valuable ideas or inventions are hatched with delightful ease. Such ideas are not generated in a mind that is too

lazy to cogitate, or that is preoccupied with the daily trifles of life. The mind can be disciplined or driven to this effort until it works habitually and automatically to conceive and invent. Lack of an inherited talent is no excuse for failure. The man who does not acquire these mental habits may blame his poor heritage, but he is likely to spend his life working under the direction of some man who has acquired them.

From all of these considerations, it is clear that a certain self-discipline can do a great deal in enhancing the successful conception of ideas and carrying them out as research projects. After an idea has been conceived as a possible project, it is always profitable to subject it to systematic consideration, according to some such scheme as this:

1. Is the project of really worth-while importance, considering the other things that could be done with the same time and resources? Is it something that clearly fits into the company's policies and is it the next major step of progress if it is successfully worked out?
2. If it is worth while, what are the prospects of success in its working out? Does it withstand detailed scientific analysis from the theoretical standpoint? Much experimental work results from ignorance of the established scientific laws. It is easier to look up these laws than to discover them experimentally, and is much less expensive. Indeed, aided by adequate knowledge of the laws of chemistry and physics, and by reference works, one can do much research with no apparatus.
3. Has it been done before? It is, of course, exceedingly unsafe for a man to assume that, since he does not know of a thing and had not thought of it before nobody else ever thought of it. The time to search patents and previous literature on the subject is before actual research is begun, and not after it is finished.
4. Are resources of time, money, men, and apparatus available to carry the project to successful completion? Of course, one cannot always foresee what direction a project will take or everything that will be required, but it can be foreseen frequently that a project is too big for the resources available, or too speculative and expensive.

If the research man lives up to all of these requirements, he is a good one. Research, however, is subject to the individuality of the man, for research men are, or should be, thinkers who do not conform to rules. But even marked individuality does not enable a man to violate the laws of nature, escape the penalties of sloppy and inaccurate thinking, mental laziness, or inability to tell what he knows in understandable language.

The General Practitioner

By Samuel S. Sadtler

The head of a Philadelphia consulting firm tells of some of the aspects of the consultant's practice. The chemist as the physician to industry.

"TAKE interest, I implore you, in those sacred dwellings which one designates by the expressive term 'laboratories,'" said Pasteur.

At the time of the dedication of the Edison Laboratory which Henry Ford had moved from Menlo Park to Dearborn, President Hoover said that Thomas Alva Edison had not only invented the electric incandescent bulb, but that he "gave an outstanding illustration of the value of the modern method and system of invention, by which highly equipped, definitely organized laboratory research transforms the raw material of scientific knowledge into new tools for the hand of man."

Modern industry is in a state of continual flux and change. This may be a change in the method of manufacture, or it may involve abandoning certain products and taking up new ones. Such a condition is brought about by our progressive spirit, either instituted by ourselves or forced upon us by others. In some countries there is so little change that it seems to be a handicap.

The writer, visiting a textile plant several years ago, was told that about 20% of the entire plant was generally in process of reconstruction because of the change in styles. Probably this condition is more apparent in the textile industry than in others, but it pervades all lines of business to a greater or less extent; and the more we can be prepared for changes by conducting research, the better off we shall be.

Research should be carried out continually so as to have some proposition ready for putting into production when needed, avoiding long periods during which nothing is produced and no money made while research seeks ways of making profits.

Those who are unprepared or are stubborn go under. A government bureau found on investigation that about one-half of the corporations reporting to them conducted some kind of research; but of those who claimed thay were conducting research, a proportion were certainly not doing so adequately. As to this changeableness in business, the *Shaft* says, "We have not changed planets but we might just as well have done so. This is a new world we are working in. Smith is no longer Jones' competitor. His real competition is a changing Universe. Silk is battling rayon, railroads are fighting bus and air travel, concrete wars with lumber, and the world grows each hour more complex."

Requirements of the Consulting Chemist

The consulting chemist must have either wide knowledge or special knowledge if the public are to beat a path to his door. I shall discuss the chemical consultant whose knowledge should be wide, rather than special.

He must have experience, good judgment, and resourcefulness, or there will not be a definite and much trodden path to his door. If he is not a student he will fail in these times, for the day of the genius has passed. He must be exact and painstaking. Hans Goldschmidt said that when he was a student under Dr. Bunsen, the latter had given him a problem to solve. Goldschmidt after a while thought he had the answer, as he had obtained the same result three times, and so he handed in his work as finished. But Dr. Bunsen handed it back to him with the remark,"When you have got the same result thirty and three times, you can consider the work completed." Goldschmidt found his error.

Importance of Ethics

Of course the consulting chemist must be ethical. He will doubtless belong to one or more professional societies with codes of ethics to which he has subscribed. But there remain a few who are untrustworthy and dangerous to deal with. I shall tell about an instance of criminal lack of ethics.

Many years ago a client asked if we could make a ton or so of a safety explosive, of a kind that we had already made for him in a small way. We said we could not do so with existing facilities, and that it would require too much in time and money to create the needed equipment.

He dropped into our office a week later and told us that a chemist in another city had agreed to make his explosive for him at a cost of about $1200 a ton, or sixty cents a pound.

The powder was delivered by freight, packed in paper tubes like dynamite, and was demonstrated before a group of prospective investors and quarry men. It did great execution —broke down large quantities of rock and was fine for "mudcapping."

It was all used save one stick. This was sent to us for analysis, for probably no reason at all, as no one entertained any suspicion regarding it. The writer started to analyze that himself; but before he had it fully sampled he had a splitting headache.

TITRATION DEPARTMENT

Then someone became suspicious. It seemed too much like a nitroglycerine headache, and the safety stuff could not conceivably do this. Upon further examination, the explosive turned out to be ordinary 40% dynamite. The difference between the cost of this and $1200 was available for the unscrupulous chemist.

A great many people are taken in by price cutters, but they find in time that this seemingly cheap work is really expensive; and they then look up the man who has a reputation for good work to maintain.

What the Consulting Chemist Does for His Living

The consulting chemist is employed by the business man. I cannot take space here to recite the things, purchased by corporations, which require chemical testing.

Many years ago a man came in to tell us that his company (not very strong financially) had spent $5000 for a copper extraction apparatus, which they had used with carbon tetrachloride as a solvent. Now, carbon tetrachloride, with the help of a little water, has a way of dissolving metals. It ate up, or ate holes in, this apparatus in a short time, converting it into scrap.

This was a case of getting chemical information by hearsay and not

LABORATORY OF THE SADTLER CO.

from a chemist. We found for the company a process that did not use metal-hungry chemicals—but the $5000 was gone.

Effect of Chemistry on Business

The influence of the analytical and testing laboratory has done much for the morale of business.

Business is certainly now comparatively free from the irregularities of a generation or more ago. We do not know all the factors that brought about this change, nor do we need to. One factor, however, has been the buying on tests of a chemical or physical nature. This country took the lead in developing testing laboratories; and the economies which resulted helped place us in the lead in manufacturing throughout the world. The use of so many college trained young men in selling and purchasing positions has also had a salutary effect on commercial transactions.

Sales engineering did not come to the chemist as early as purchase engineering, but it is here. There are the following steps in every modern, complete sale: (1) Secure attention. (2) Arouse interest. (3) Create desire. (4) Explain method or means. (5) Close. (6) Follow up to keep customer satisfied.

It will be obvious to any one that in large transactions the consulting and analytical chemist may be called in for any of these elements, except possibly closing the transaction. That is the salesman's job, alone or with a super-salesman. The reports of the chemist are used greatly in promoting sales, but they should be used ethically. There was the rub

until the business man came to appreciate ethics himself and joined his own craft association.

The chemist is often consulted in connection with commercial disputes and litigation. In early stages and mild cases it is to furnish analyses and reports. In case of arbitration, the chemist may serve—or he may go to court to present testimony. Probably arbitration will grow at the expense of litigation.

Chemists are popularly supposed to be busy finding valuable waste products that are redeemed at little expense and great profit to the business man. This pioneering stage, however, has been largely passed. I believe the consultant is busier showing means of saving costs by producing better products and with greater efficiency.

Research work is fairly well sold to the public, after some years of effort, and it has done much for the supremacy of this country. The outside chemist should be consulted in all important work of this kind. It is vital to the manufacturer to know that he is getting the best possible process, otherwise he meets competition too soon or too strongly.

Varied Calls

There are many elements in the work of chemical consultants. There is that of furnishing general information where chemistry is in question. An example of this is the following.

Some years ago a monumental building was being erected. Much to the surprise and disgust of the owners the granite began to change color, due to atmospheric influences, and to be stained with what looked like iron rust. It was decided not to go on with the building unless the trouble could be corrected.

Our firm was called in to make a complete study of the causes of the discoloration of the stone. It was found that after considerable discoloration or rusting, the disfiguration did not progress further. The surface could be cleaned and would look and remain as the architect had expected it would appear.

An investment of millions of dollars was protected by obtaining this knowledge at very slight expense. The building has long since been finished. Except for the dashes of soot that are wafted about in large cities (due to incomplete and wasteful combustion of the fuels) it is in a satisfactory condition today.

A large part of the work of the consulting and analytical chemist is due to troubles in manufacturing. If the search for the difficulty is thorough, the process should be better than ever.

Chemists are regularly called in today to help in national advertising.

Recently a large advertising agency had us make a considerable investigation to ascertain whether a lack of complete success in a campaign was due to faults in the article being advertised, or to failure in the advertising plan.

The article itself would not ordinarily be considered a chemical substance; yet everything ponderable is chemical. Faults were discovered in the article; or, to be more precise, some advances had been made by competitors which our client's client had either not appreciated or not adopted. As the article has since been put in line, it is reasonable to believe that the advertising specialists will now have greater success in their campaign. An article must be nearly perfect to stand advertising. Advertising will not sell but only show up a poor article.

Two Attitudes

Many manufacturers try to get by without research. They endeavor to discover what their competitors are doing by other methods. Often with only hearsay information they try to reconstruct the process in their plant. I fear the lack of success of many manufacturers is the result of trying to dodge paying for research. Money thus spent is a profitable investment.

As we have often said, "Nothing pays like research." The public are becoming quite canny as to chemistry, and the consultant can expect to be appreciated if he does good work. Success with research is the product of the research resources and their aggressive use.

Meredith has well said, "Every failure is a step advanced—to him who will consider how it chanced."

BY-PRODUCTS

We Make Our Bow

WE ARE hesitating between the clubby "Hello, everybody!" and the more conservative "To whom it may concern" which, after all, takes less for granted. What we started to say was that the optimistic Editor of THIS JOURNAL has, with his usual courtesy, allowed us to establish this department, in which we purpose to think out loud periodically. It is our fond hope that the capricious comments here dispersed may be found edifying and stimulating or possibly informative, though no confidence is expressed as to the latter. We intend to be candid but careful, pointed but painless. And, of course, we shall remain anonymous, not so much to escape the consequences of audacity but rather to gain the freedom of irresponsibility and modestly to let the ideas here reported survive or perish on their own merits. We are bowing.

"I no longer pray that people shall say what they mean. I shall be satisfied if they can understand what they say."—Attributed to Carbonium Gnitrate.

Replying to Balderdash

WE SUPPOSE that what may be termed the "Ithuriel complex" is common in some degree to all men, being particularly active in our adolescent years, before the mellowing influences of senility bring a realization of the intellectual serenity that accompanies toleration. The urge to controvert with decision and despatch all utterances that appear fallacious seems to arise in the emotional field under provocative circumstances as a sort of reaction inherent in our human nature. We have observed that the tendency to control this complex increases with age and with understanding. Possibly the psychologists can at some future time arrange the factors in a modified van der Waal equation, some sort of PV/RT relationship—which seems appropriate, since both stimulation and reaction are very likely to appear in the form of gases at elevated temperatures and pressures.

How remarkable it is, after all, that no one seems to respond to the flood of ill-informed, undigested, incompetent, and too often malicious criticism that is annually poured upon a defenseless public. Toward

this deluge of half-truths, no-truths, splenetics, and supinities we oppose only our ability to ignore them or to convert them into objects of farcical humor.

Some of the articles that constitute this flood are condiments. They spice our thinking much as asafetida spices the Arab's dinner. Others are irritants and serve no more useful end than to exhibit the quality and reliability of their authors' mental powers. This idea may furnish an acceptable explanation of the fact that no one troubles to reply to such writings. Instead of an overwhelming blast of condemnation based upon knowledge and precise thinking, these half-precocious thinklings, when they do draw fire, draw replies only from one of their own type. Those who are equipped by information and logical powers to expose immaturities apparently consider them already self-evident.

Misinterpreting their immunity, the offenders continue to attack (with little restraint of language and smaller show of understanding) institutions, professions, and activities of all descriptions without being publicly castigated.

Is not the indifference of the competent the severest condemnation of the inept?

Science Says

A TOO common form both of popular speech and of journalese for introducing some remarkable thought is the two words that caption this paragraph. It appears to be immaterial whether the reference is to a generally accepted conclusion or to a carelessly formed opinion uttered by a worker in some field of science. Aside from the self-evident truth that "Science" cannot speak, being not only speechless, but non-existent, the use of that form tends to remove from the individual the responsibility for the statement made and to throw it impartially on the shoulders of all scientific workers. Few men are qualified to speak in generalities about their own departments of scientific study. The day is past when anyone might speak authoritatively for all science. When "Science speaks" someone is doing the talking. The responsibility, if any, is personal.

Thomas A. Edison

THE wizard of Menlo Park now belongs to the ages, but it will be a long time before we have exhausted the mental contents of his life. In meditating on the man, the thought occurred to us that Edison had led very nearly the ideal existence. He was born poor, which

advantageous circumstance early forced upon his mind, in addition to a true sense of values, the fact that he must and could realize his desires by his own unaided efforts. But the ideal factor was that during the greater part of his life he was able to do those things that he most wished to do. Achieving enough of financial independence in early life, he was able to build his own laboratory. There he attacked the problems that absorbed his attention and which he loved to solve. That he had the wisdom to choose substantial intellectual satisfaction through accomplishment rather than merely "enjoyment of life" must arouse our admiration—as it undoubtedly contributed most to his happiness. Edison worked for the joy of the labor and lived every moment of his life. No man can ask for more.

Careers for Cats

AS PART of our household equipment we own a heterogeneously colored cat. This feline vertebrate rejoices in the name of Poison Ivy, to the implications of which she seems serenely indifferent. On the contrary she responds to the name with alacrity, especially when the call is reinforced by the exhibition of some gastronomic appeal. Poison Ivy is remarkable in one direction. She has an unusual voice—unusual in tone, timbre, and quality. Her grammar is, of course, bad as Mark Twain said the grammar of all cats is. But her voice! There we have her one distinction. No cat was ever graced with a mellow and melodious tone like the gentle lowing of contented kine; but Poison Ivy's voice is raucous even for a cat. It combines the best elements of saw-filing with a reminiscence of a band saw negotiating a pine-knot, modified by being off-key, flat, and nasal.

Sometimes when we sit comfortably at home wrestling with the insoluble problems of the universe and listening to the radio, one of these modern young lady singers who are so popular just now breathes a soft palatal moan across the ether like a balmy southern breeze sweeping over the clam-flats. We wonder whimsically if there wouldn't be a great future for Poison Ivy as a crooner on the air.

—*The Autocratic Chemist*

David Wesson, Utilitarian

By Alan Porter Lee

The story of a chemist who judged his work by whether or not people could eat it. An amazingly successful experimenter who turned his talents to developing a hitherto unexploited natural resource.

MOST great chemists have approached their profession as scholars. This is the traditional attitude and perhaps the most common one; but more and more we find distinguished chemists whose major attention has been focused on the practical aspect of their work. One pioneer in this attitude was David Wesson, whose complete absorption in the practical is symbolized by the fact that his name appears in the literature attached not to an obscure reagent or reaction but to a product in everyday household use—Wesson Oil.

Dr. Wesson's very entrance into chemistry was motivated by practical considerations. His desire as a boy was to be a physician. Recognizing, however, that most physicians were woefully lacking in knowledge of chemistry, he decided to specialize in that science as a preliminary step in his medical training. After he had spent one year in the Polytechnic Institute of Brooklyn, his family moved to Brookline, Mass., which made M. I. T. a more convenient place to study. Massachusetts Tech, intensely concerned with industry and engineering, lured the young student into metallurgy.

Already straying from the path that led to medicine, Wesson went still further afield when he took a year out from his studies to assist his father in the family's wholesale boot and shoe business. In spite of metallurgy and commercial activity, however, his interest in medicine survived. It survived so strongly that young Wesson became one of the few people to

have a literal skeleton in his closet. To advance his studies, he borrowed a skeleton, took it home piece-meal, and secreted it in his room, where he studied it with the aid of Gray's *Anatomy*. His mother was let in on the secret; but his father had to be kept in strict ignorance of the fact that his home was harboring so unusual a visitor.

Returning to Tech, Wesson completed his course in metallurgical chemistry. He felt that he was now thoroughly prepared for one profession and not particularly far advanced toward the one of his original choice, and he decided to give up the idea of being a physician and to become a chemist.

WESSON stayed on after graduation as assistant to William Ripley Nichols, professor of general chemistry and philosophy. This work consisted of setting up lecture table experiments, taking the attendance, and assisting in the laboratory.

Wesson greatly enjoyed his work with Professor Nichols. He found the periods in the laboratory instructing the students particularly interesting, as he enjoyed teaching—though he discovered that two hours spent answering questions from many different angles could make one tired without physical exertion. Much as he enjoyed the work, he could not see any great future in a teaching position, especially as he was ambitious to get married and have a home of his own.

Looking around for any chemical job he could get, he took a position with the N. K. Fairbank Company of Chicago, lard and soap manufacturers, at a salary of $50 per month. Here began his interest in oils and fats, the interest which was to remain with him through life and to make him famous.

His first work was in the testing laboratory; but the young chemist, ever practical, soon decided that the testing laboratory was not the place for a young man to progress. As soon as the managing chemist left for New York, Wesson captured one of the young errand boys of the plant and instructed him in making the necessary chemical determinations. He himself then moved out into the plant. It may be of interest to note that this errand boy was James Boyce, who later became chief chemist of the company.

After Wesson had been three years in Chicago, part of the Fairbank plant was burned down. By this time Wesson was in charge of the oil refining. It fell to him to keep things going and arrange for rebuilding. This pleased his practical mind intensely. Taking charge personally of a crew of pipe fitters, he converted soap tanks into lard tanks, installed emergency equipment, and put the factory into condition to resume opera-

tions on a temporary basis. Then he got out a drawing board and drew plans for a new refinery. Confident of their fitting into a co-ordinated plan, he gave his drawings to the builders as fast as he turned them out; and he kept just ahead of the workmen until the plant was finished.

He now faced the still more difficult task of explaining why the improvements he had instituted cost $10,000 more than the insurance money the company had received. After considerable dispute, he finally offered to let the board of directors take the sum gradually out of his salary, if his salary should include all the money saved by the new equipment. That stopped the argument.

It was about this time that the N. K. Fairbank Company was absorbed by the American Cotton Oil Company. Wesson fitted up his laboratory for the purpose of studying the work done by the numerous cotton oil mills belonging to the larger company. It was here that the first systematic analysis of cotton oil products from all over the south was started. He discovered that many of the mills were working in an exceedingly wasteful manner, so that the company was losing money by the operations. He also discovered that the reason the mills in Texas produced less oil than the mills in the Carolinas was that the seed in the two sections differed.

Convinced that their young chemist had potentialities outside of purely technical work, the company now used him as their foreign agent, principally in supervising the unloading of tank steamer shipments in Holland. Some of the work here, however, proved too much even for his versatility. Faced with the problem of convincing the hard-headed Dutch that a tank steamer of year-old oil was perfectly good, he found that his own scientific convictions in the matter detracted from his usual forcefulness. The tank steamer lay idle at the dock; the company fumed. Wesson finally returned to this country, where, finding that another chemist had been appointed to his position of head chemist, he resigned. He describes this as one of the wisest steps he ever took.

Looking about for a new enterprise, he fell in with a man who suggested that the two of them go into the bicycle business, then very flourishing. They formed a company, leased a factory, and began making bicycles. The company lasted for the duration of the bicycle craze, which expired simultaneously with the end of that particular period of prosperity. Wesson was once more left looking for an occupation.

SINCE he had a little money by now, he set up an experimental laboratory and returned to his old love—fats and oils. Traditionally, there ought to have followed a long period of patient research and dis-

appointing results. No such thing happened. Meditating upon the factors that ought to produce desirable oil, Wesson marshalled his ideas and then set up the apparatus. The first experiment was a success. The product, the finest oil that had ever been seen, was the famous Wesson Oil.

The young experimenter showed his product to Henry C. Butcher, then president of the Southern Cotton Oil Company. Butcher saw at once the possibilities of the new oil and suggested that they go into partnership. The Wesson Process Company was formed, an organization which has added immensely to the wealth of the South by the increase in value it gave to the cotton crop.

In his new enterprise, Wesson had full play for his engineering training and his practical mind. The first plant was built in Savannah in 1899. Wesson Oil has grown and found an increasing market ever since. In the years 1912 and 1913 Wesson had to start refineries in Germany and England.

All through this period, his problems were those involved in devising machinery for quantity production, a problem which has always fascinated him. During the early days, however, his was the responsibility for every sort of activity, from directing refining to writing the company's advertisements.

One of the incidental plant problems was a particularly joy. This was the necessity for first-aid and occasional cases of mild surgery, an activity in which Wesson found a measure of sublimation of his early desire to be a physician. Hailing joyfully each new accident, he repaired to the scene with his kit and bound up the injured workmen.

His prize surgical case he regards as that of a negro who got into a shooting affray and sustained a severe gunshot wound. Wesson methodically went about tying up the severed arteries, consulting his copy of Gray's *Anatomy* as he went along. When all the proper connections had been made, he called the ambulance.

THROUGHOUT the history of the Wesson Company its fortunes have been bound up with those of the Southern Cotton Oil Company. Wesson himself remained on the staff of Southern as manager of the technical department. He is still technical adviser to the company.

Wesson's searching for the practical and his sound knowledge of theoretical procedure have given him the faculty throughout his career of being just a little ahead of his associates and of his competitors in the technology of oil refining and food manufacture. The quality of products manufactured under his direction has always been a little superior

to that of competitive products, and his associates have found him able to improve manufacturing methods in advance of the industry as a whole.

An outstanding example of this ability was noted at the time of the first adoption of oil hydrogenation processes in this country. A competitive manufacturer introduced the process from Europe with great secrecy; but Wesson's keen analytical faculty quickly identified by examination of the products the methods used by the competitor. His business associates were very skeptical, but Wesson's engineering and constructive ability asserted itself. Within a very short period he had demonstrated by actual production that his analysis of the competitor's product and methods was correct.

Wesson's chief interest has always been in oils; but he has not neglected the other aspects of chemistry, particularly in the food industries. Another interest has been in publicity pointing out the economic value of chemists. Long known as a forceful and instructive speaker, he has made numerous addresses before chemical societies and trade associations. His contributions to chemical progress include studies of the properties and utilization of fuller's earth, hydrogenation of oils, rancidity and its causes, and the manufacture of catalysts.

NOW relieved of the necessity for active participation in plant work, Dr. Wesson has returned to the laboratory. At his home in Montclair he has equipped both his cellar and his barn as laboratories, where he works on new problems. His favorite is a meatless sausage which he expects to have on the market before long. Already successful in the laboratory, there remain to be solved only the problems of quantity production; and this is Wesson's own particular field.

To those who have known him intimately, one of Wesson's outstanding characteristics has been his helpfulness. Never too busy for a word of encouragement to the young chemist, he had helped in securing positions, in suggesting courses of study or research. He has launched many young men on successful careers in chemistry and chemical engineering.

Wesson's genial, friendly nature has endeared him to all his associates and professional acquaintances. He has been prominent in the scientific societies and clubs of which he is a member. A charter member and past-president of the American Institute of Chemical Engineers, he also helped found the American Oil Chemists' Society, later becoming its president. For many years a member of the American Chemical Society, he has been prominent in the work of the New York and North Jersey Sections and is past-president of the latter section. He is a

Fellow of the American Institute of Chemists. His clubs are the Cosmos and the Chemists'.

For diversion Dr. Wesson spends his summers sailing on Barnegat Bay in the 35-foot knockabout sloop which constitutes his favorite hobby.

While he is in Montclair, he loves to potter around in old tweeds, growing prize roses. Another interest is antique-hunting, at which he shows knowledge and taste.

Probably no profession has members with as many different intellectual attitudes as has chemistry. Wesson stands as the high priest of those who demand practical results. He keeps up with theories, too. His study is piled high with scientific publications. But to arouse his own lively personal interest, an object must have an obvious practical use. With no thirst for fame as one of the great theorists of science, he is happy if he can make a hitherto neglected oil into something the race can eat. There may be chemists whose labors have been in answer to a higher, purer call of learning; but the jovial Wesson telling a humorous story to his friends or sailing at the wheel of his boat makes it pretty apparent that his background of life-work has been satisfactory. Probably few scientists have enjoyed their lives more.

Positions Wanted

The following chemists are available for positions. Further information will be furnished upon application to the American Institute of Chemists, 233 Broadway, New York, N. Y.

101-XX	Chemist experienced in analysis of metals, rubber, paper. Some research experience.
101-QT	Ph.D. with wide experience in food products. Head of laboratories of various canning companies.
101-PQ	Chemistry professor. 15 years' teaching experience.
101-IN	Chemical engineer experienced in high vacuum and the chemistry of air gases.
101-ZN	Research and plant chemist experienced in cement, leather, high explosives, acids, fertilizers.
101-MO	Research chemist experienced in explosives, dye intermediates, acids.
101-HW	Paper chemist, research and development work.
101-DP	Recent graduate, industrial position.
101-ID	Chemical engineer, nine years' experience plant work and management.
111-NQ	Chemist, 11 years' experience. Research, analysis of metals.
111-OX	Organic chemist, experienced as chief chemist and director of research.

BOOK REVIEWS

Science Today. A Symposium. Edited by WATSON DAVIS. *Harcourt, Brace, and Company.* $2.50.

The question of how scientific achievements are to be presented to the public is always a problem. One of the most modern methods is represented by *Science Today*, a collection of radio talks given under the auspices of *Science Service*.

As is to be expected in a collection of this sort, with forty-seven contributors, the result is uneven. Some of the articles are pseudo-scientific rather than scientific, in one or two instances approaching the field of the pulpwood magazines. Such an article, unfortunately, is "A Future Journey to the Moon," which put *Science Today* in the headlines of metropolitan newspapers. Also, it is a question whether so controversial a subject as the Gurwitsch rays was worth presentation to a radio audience. The public is too easily baffled as soon as the word "ray" is mentioned; and when the author makes the statement that the Gurwitsch radiations are in the ultra-violet without being ultra-violet, he leaves the scientific profession in the dark as well. Surely there are more important modern manifestations of science which could have been given this place.

Perhaps we are over-fond of our own subject; but it seemed that for a picture of "science today" the book discussed far too little of the work of chemistry. Possibly the continuation of the series contemplates dealing with chemical science. Certainly a well-balanced list of scientific treatises ought to include some discussion more purely chemical in nature than Compton's "Adventures with Electricity in a Partial Vacuum," probably the most nearly chemical of any of the papers.

With the actual presentation of the subjects we must quarrel in some of the instances. We regret that Dr. Sylvanus G. Morley, of the Carnegie Institution, neglected altogether to discuss in his presentation of the Maya civilization the fascinating topic of the Maya glyphs, with the vast possibilities that their ultimate unraveling contains.

Science Service has had a splendid idea in inaugurating this series. Unfortunately material adequate to hold the attention of a radio audience often looks pretty thin in print. It is to be hoped that if the series continues the authors will be able to organize their subjects a little more effectively.

E. L. G.

Annual Survey of American Chemistry. Edited by CLARENCE J. WEST. Published for the National Research Council by the *Chemical Catalog Company.* $5.00.

At the opposite end of the scale from *Science Today* is the *Annual Survey of American Chemistry,* compiled by the National Research Council and now in its fifth volume. In forty different fields of American chemistry authors of established reputations have collected brief abstracts into a running account of the work of American scientists throughout the year. For the most part the material is printed without comment, except such comment as is implied in the method of organizing. Even the chapter on chemical economics, edited by Lawrence W. Bass, simply records the publication of papers dealing with economic subjects.

The great weakness of this year book is, of course, that it deals only with American and not with world chemistry. It is to be hoped that some organization will take a step toward greater comprehensiveness. There is some doubt in this reviewer's mind as to the value of a work so technical as to be of interest chiefly to the workers in a particular field, who will be driven in any thorough study to consult *Chemical Abstracts* for fear of missing a foreign publication of vital importance.

The *Annual Survey* is a success as it now stands; but it would probably be more of a success if it moved in one or two directions. It might well become less technical or else include the entire field.

E. L. G.

O. P. M. By GARET GARRETT. Published by the *Chemical Foundation.*

The Chemical Foundation has reprinted under the title "Other People's Money" two articles by Garet Garett, in which the *Saturday Evening Post* writer discusses the situation as regards German reparations and debts.

No class of people is more interested in the status of Germany than chemists, especially with the German I. G. pursuing an imperialistic policy. The capital of the I. G. is at work absorbing chemical industries in Rumania, at the same time that Germany pleads the necessity of borrowing foreign capital for her own domestic use.

In preparing Mr. Garrett's two papers for publication in booklet form, the Chemical Foundation has included without comment a great many illustrations of the splendid new factories, apartments, and workers' houses built in Germany by the lavish expenditure of borrowed credits. We recommend *O. P. M.* for the consideration of all chemists.

E. L. G.

OUR AUTHORS

Cosmetic Chemist

Raphael Frank Revson, F.A.I.C., was graduated from the University of Georgia, then came north and joined the staff of the Public Service of New Jersey, where his work was chiefly with coal and coke. Now Mr. Revson is interested in chemicals of a different nature—rouges, powders, and perfumes, a line into which he was led by his work on colloidal clays. Of medium height, slender, dark, Mr. Revson's ambition is to improve the quality of cosmetics. For diversion he collects stamps and minerals.

The Chemist and Stock Poisoning Plants

James Fitton Couch, F.A.I.C., Ph.D. (American University), was graduated from Harvard in 1913. After four years in industrial work and commercial chemistry, he joined the staff of the Department of Agriculture, where he has been ever since. Most of his publications deal with plant toxicity, although he has published also a dictionary of chemical terms.

Of medium height, dark, Dr. Couch has a philosophical nature, spends his spare time as professor of the history of science at National University.

Whether by nature or by philosophical decision, he has a pleasant disposition. He numbers a great many chemists among his friends.

Stabilization and the Chemist

J. N. Taylor, F.A.I.C., who wrote the recent biography of Dr. C. E. Munroe, appears again in our columns, this time with a thought on economic problems. Also due to the efforts of Dr. Taylor (although not heretofore acknowledged) are many of the articles appearing in the "Contemporary Thoughts" department.

Dr. Taylor denies our description of him as "chief of the organic division," denies, in fact, the existence of an "organic division." He describes his job as that of keeping his eye on developments, work

in which he finds that the organic branch of the chemical industry recognizes the importance of research. Other branches, he feels, would profit by a similarly close liaison with science.

Always interested in his fellow chemists and in professional problems, Dr. Taylor is a writer from whom we hope to hear more.

Economic Research for the Chemist

David P. Morgan, Jr., F.A.I.C., brings to his study the point of view of Wall Street, where he is engaged in business research. To investment bankers the spectacle of intelligent young men spending time and money with only a hazy idea even of the possibilities is apparently a cause for surprise. Dr. Morgan's suggestion of economic surveys for young chemists by experienced chemists is a good one. We hope leaders of the chemical profession will contribute such articles.

Director of Telephone Research

R. R. Williams was graduated from the University of Chicago, worked for the government and industry on vitamines (strangely enough, in view of his present work). In 1918 he joined the engineering department of the Western Electric Company, now the Bell Laboratories, becoming head of the chemical research organization in 1924. Under him are 150 workers, who attack all the chemical problems of electrical communication. Under his direction "paragutta," the new submarine cable insulating material, was developed.

Retaining biological chemistry as a hobby, he has continued his work on vitamines in co-operation with Professor W. H. Eddy of Columbia; and he has assisted his brother, Professor Roger J. Williams of Oregon, in his work on the "bios" of yeast.

Fire Protection Expert

C. J. Krieger, a graduate of Rose Polytech, began his chemical career in the control laboratories of the Illinois Steel Company. After six months of this work he changed to the Underwriters' Laboratories, where he has been ever since, first as a testing chemist working particularly on cable insulation and fire hose, and afterward as an executive. He is now special agent and contact man in charge of inspection.

Mr. Krieger expresses himself forcibly when he talks, and creates the impression that he is thoroughly up on his subject. For di-

version he plays golf and spends his time in the country with his Irish terrior.

Wesson Biographer

Alan Porter Lee is a consulting chemical engineer whose specialty is oil and fat refining, the professional connection in which he was thrown into contact with Dr. Wesson. After industrial experience with various companies as refinery superintendent, general manager, and president, he turned consultant, also became editor of *Oil and Fat Industries* and technical editor of *Soap*. Now his consulting practice takes all his time except that which he spends editing the Gillette Publishing Company's new magazine, *Oil and Soap*.

Tall, muscular, prematurely gray, Mr. Lee has an active and original mind, habitually approaches problems from angles which never occur to other people. He likes tennis, bridge, old and new books; but he is never so happy as when he is designing plants or plant machinery.

"The General Practitioner"

Samuel S. Sadtler gained wide chemical experience as chemical examiner for five years in the United States Customs House. For the last thirty years he has been with the Sadtler consulting firm. Tall, slender, unusually agile for one of his 58 years, he likes to walk and ride, sometimes pauses to take photographs.

Research from Two Angles

Harden F. Taylor become interested in fishing when he spent his college vacations as assistant chemist in the Marine Biological Laboratory of the United States Bureau of Fisheries. After being graduated from Duke University (then Trinity) he stayed on with the government, rose to the position of chief technologist of the Bureau of Fisheries, later headed the Division of Fishery Industries.

Leaving the government service to become director of research of the Atlantic Coast Fisheries Company, he finally became the company's president.

Energetic and intelligent, Mr. Taylor is a man of wide interests. His hobbies are oceanography, philosophy, photography, golf.

INSTITUTE NOTES

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National Council Notes

A meeting of the National Council was held on November 12th at The Chemists' Club, with President Frederick E. Breithut presiding, and with the following officers and councilors present:

Messrs. Arnstein, Crossley, Harold, Herstein, Jones, Knight, Neiman, Sachs, and Zons. Edward L. Gordy, Editor of *The* CHEMIST, and J. W. H. Randall, chairman of the committee on membership, were also present.

The secretary reported that E. R. Weidlein, A. E. Guest, and W. A. Hamor had accepted the invitation of the Carnegie Institute of Technology to represent The American Institute of Chemists at the Third International Conference on Bituminous Coal, at Pittsburgh, Pa., on November 16th to 21st.

The secretary also reported that there had been communications with Howard W. Post, assistant professor of chemistry, University of Buffalo, relative to the formation of a Buffalo chapter.

The president called the attention of the councilors to the importance of considering candidates for the offices to be filled at the next annual meeting.

The question of the medal award was also discussed at length.

It was decided to have copies of the report of the committee on education printed and put into circulation by whatever measures the committee considers necessary.

Mr. Jones reported that an effort is being made to form a junior chapter at the University of Pennsylvania.

Dr. Breithut spoke of a similar movement at Brooklyn College.

Dr. Zons, chairman of the budget committee, presented the report of that committee. The report was referred to the Board of Directors.

Dr. Knight, chairman of the committee on ethics, presented several suggested amendments to the code of ethics.

HOWARD S. NEIMAN, *Secretary*

New York Chapter

A meeting of the New York Chapter was held at the Chemists' Club on Friday, November 13th, with Chairman Frederick Kenney presiding. The main address of the evening was delivered by C. J. Krieger, of the Underwriters' Laboratories, who spoke on "The Chemist in Relation to the Work of Fire Protection." Mr. Krieger's speech is reported in full elsewhere in this issue of *The* CHEMIST.

After the discussion of the paper Chairman Kenney pointed out that in times of depression professional organizations are particularly valuable, and suggested that the present was a time when the Institute might well expand its scope.

Pennsylvania Chapter

On November 3, 1931, the Chapter made a tour of the Queen Lane filter plant, under the guidance of Lyle L. Jenne, F.A.I.C., sanitary engineer of the Philadelphia Water Department.

Mr. Jenne showed the group how the water is treated with alum, then filtered through either slow or rapid sand filters before chlorination. He also demonstrated the methods for cleaning the sand beds, both mechanically and by means of air agitation and flushing. The tour was well attended and highly instructive.

BENJAMIN LEVITT, *Secretary*

A meeting of the Philadelphia Chapter was held at the Engineer's Club, November 3rd, with Franklin D. Jones presiding.

The address of the evening was delivered by Professor Walter Taggart, who had just returned from four months in Europe. He gave a very lucid description of the plants and universities visited, and he described as well the meetings of the Society of Chemical Industry and of the Faraday Society.

Professor Taggart reported that, in general, conditions in Europe are bad. In Berlin he found very little activity. Shops and factories were closed, stores and hotels empty. In Vienna, once one of the gayest cities in Europe, conditions were even worse.

Dr. Taggart was particularly interested in nickel, and visited the plant of the International Nickel Company at Acton. This is now really a platinum refinery, a large part of the world's platinum now being obtained from the Sudbury nickel ores. The Mond or nickel carbonyl process is used.

In recovery and separation of the platinum metals, need for a market for palladium has developed. It has been plated upon silver with some success, a non-tarnishing metal for jewelry being obtained.

Dr. Taggart also described the National Physical Laboratory; and he commented upon the fine personnel of these organizations.

In conclusion he exhibited some fine snapshots.

HOWARD STOERTZ, *Reporter*
BENJAMIN LEVITT, *Secretary*

Washington Chapter

On Friday afternoon, November 20th, twenty-six members and guests of the Washington Chapter went on a trip through the plant of the District of Columbia Paper Company. The trip was arranged by the sales promotion manager, Mr. D. E. Darby, of the paper company. Divided into two groups, the visitors were shown features of the plant by J. M. Kraus, chief chemist, and B. W. Forshee, assistant chemist. Wood pulp machinery, actual paper manufacture, the process of pattern transference, all were examined. An especially interesting exhibit was the velour paper, which has a velvety finish produced by dusting powder onto a sticky surface.

A short business meeting followed the trip, with Chairman D. F. J. Lynch presiding. Plans for a trip to Baltimore were discussed.

J. David Reid, *Reporter*

New Members

The following were elected to membership at a meeting of the National Council of the Institute, held on November twelfth:

Fellows

C. C. Concannon, Chief, Chemical Division, Department of Commerce Washington, D. C.

Associates

Harold H. Herr, Teacher of Science, Teaneck High School, Teaneck, N. J.

Juniors

Frank Brescia, Teacher, Department of Chemistry, College of the City of New York, New York, N. Y.

William Allen Buckowy, Teacher, College of the City of New York, New York, N. Y.

Hugh Augustus D'Amato, 125 North Third St., Jeanette, Pa.

Abraham L. Metersky, Independent Laundry Co., 361 Herzl St., Brooklyn, N. Y.

Applications for Membership

Fellows

Charles Barban, Consulting Chemist and Chemical Engineer, 1133 Broadway, New York, N. Y.

Johannes Sybrandt Buck, Senior Organic Chemist, Burroughs Wellcome and Co., Tuckahoe, N. Y.

Ephraim Freedman, Director, Bureau of Standards, R. H. Macy & Co., Inc., 34th St. & Broadway, New York, N. Y.

Harry Bell McClure, Technical Division, Carbide & Carbon Chemicals Corp., 30 East 42nd St., New York, N. Y.

Charles W. Rivise, Patent Attorney, 1321 Arch Street, Philadelphia, Pa.

LeRoy Davenport Soff, Chief Chemist, Paragon Paint and Varnish Corporation, Long Island City, N. Y.

Juniors

Anthony Bankowski, Junior Clerk, The Texas Company, The Chrysler Building, New York, N. Y.

Galen F. Hoffman, Student, Juniata College, Huntingdon, Pa.

NEWS

Michael I. Pupin has been awarded the John Fiske gold medal, major engineering award for 1932.

John F. Ross, formerly with the J. T. Baker Company, is now with Mallinckrodt as a research chemist.

William F. Talbot has left the du Pont Company and joined the research staff of Gustavus J. Esselen of Boston.

American Institute of Physics

THERE has recently been formed The American Institute of Physics, made up of the following subsidiary organizations: American Physical Society, Optical Society of America, Acoustical Society of America, and the Society of Rheology.

The chairman of the board of management is Karl T. Compton. As full-time executive secretary the new organization has selected Henry A. Barton, formerly research engineer with the A. T. & T. John T. Tate of the University of Minnesota will devote part of his time to perfecting plans for a publication. W. W. Buffum is treasurer.

During its early stages the Institute will be assisted financially by the Chemical Foundation.

E. H. Ballweiler gave a talk on "Chemistry and Its Relation to Medicine" to the Chemistry and Physics Society of dePaul University, Chicago.

Emerson P. Poste, consulting chemist and engineer, has opened an office and laboratory at Chattanooga, Tennessee.

Unemployment Relief

THE unemployment relief commission in New York City has organized a chemicals, drug, and paint division with Horace Bowker as chairman.

HORACE BOWKER

Vice-chairman is George A. Benington, treasurer, A. W. Groeller, both of the American Agricultural Chemical Company. The division now has twenty members with other names to be added later.

Emil Kuehnemann, manager of the wholesale drug department of Eimer and Amend, was given a dinner by the corporation to commemorate his completion of fifty years' service with the company.

He was presented by President O. P. Amend with a check for $5000 as a testimonial.

E. W. McMullen, formerly with the Celotex Company, has been appointed superintendent of the Ault and Wiborg Varnish Works.

Chemist's Hobby

A great many chemists seem to turn to the water for amusement, from the freshman having fun with a wash bottle to the distinguished and successful chemist who can spend his time fishing or yachting.

David Wesson has taken up the latter sport and is shown here at the helm of his sloop off the Jersey coast. Dr. Wesson looks especially happy because the ship's galley has just reported that in fifteen minutes there will be served a luncheon of synthetic sausages.

The coal resources of Alaska will be examined by **F. R. Wadleigh,** consulting engineer for the United States Department of the Interior, with headquarters at Anchorage, Alaska.

Nutritional research for the Walker-Gordon Company is now in charge of **L. T. Wilson,** a recent graduate of the University of Wisconsin.

Additional Relief

A NUMBER of scientific organizations in New York have combined to form a committee for the relief of unemployment. The organizations include the American Chemical Society, the American Institute of Chemical Engineers, the Société de Chimie Industrielle, the Society of Chemical Industry, and the American Institute of Chemists, with probably one or two more still to come in.

Honorary members of the committee are Horace Bowker, Francis P. Garvan, Charles H. Herty, D. D. Jackson, William J. Schieffelin, and Maximilian Toch.

The active committee is: T. H. Murphy, chairman, W. J. Baeza, secretary, and F. G. Breyer, executive secretary. They are now engaged in registering the unemployed in the chemical profession at the Game Room at the Chemists' Club, 52 East 41st Street. Members of the committee, which includes William B. Stoddard, David Davidson, Albert C. Read, William T. White, and M. R. Bhagwat, are on duty from 10 to 12 A. M. and from 3 to 5 P. M. Registrants are classified according to the degree of their necessity, the number of dependents, and the extent of their technical training.

An attempt is then made to find for these men positions in industries now not using chemists. The theory of the committee is that the over-supply of technical men must be absorbed by industry in general and that there is a considerable need for chemists in plants now unaware of that need.

T. H. MURPHY

Seek Embargo

J. Carson Adkerson, president of the American Manganese Association, has announced a campaign to obtain an embargo against manganese ore and other products from Soviet Russia.

Soviet dumping of manganese ore, according to Mr. Adkerson, has stifled domestic development and made this country dependent upon Russia for a steel ingredient vitally necessary to the national defense.

Edward R. Weidlein, vice-president of the board of trustees of Mellon Institute of Industrial Research and also director of that institution, has been elected a member of the board of trustees of the University of Pittsburgh for the period 1931–4. Mellon Institute is allied cooperatively with the University of Pittsburgh.

D. C. Carpenter delivered a talk on "Weighing Molecules by Centrifugal Force" to the East New York Section of the American Chemical Society.

Benjamin Levitt, chief chemist for Chas. W. Young & Co., Philadelphia soap manufacturers, delivered a lecture before the Philadelphia Section of the American Association of Textile Chemists and Colorists, at the Elks Club, in Camden, on Friday evening, Nov. 20, 1931. The subject of the lecture was "The Use of Soap in the Textile Industry."

French Industry Strong

Notwithstanding the depression, the French chemical industry in 1930 was maintained at a higher level than in any of the other major producing countries, as is shown in a series of reports by the United States Department of Commerce. Especially in foreign trade was the strong position of this industry evident.

Coal Conference Organizer

Thomas S. Baker, President of Carnegie Institute of Technology, and organizer of the Third International Conference on Bituminous Coal, was born in Maryland, went to Johns Hopkins until he received his Ph.D. After study

abroad, he became a professor of modern languages at the Tome School, of which he became director in 1909. After ten years in this position, he became secretary of the Carnegie Institute of Technology in 1918; president in 1922.

He is the author of "Lenau and Young Germany." Versatile, he was music critic of the *Baltimore Sun* from 1895 to 1905. In 1928 he delivered a series of four lectures in Paris under the auspices of the Carnegie Foundation for Peace. Dr. Baker is a member of Phi Beta Kappa, the University Club, Pittsburgh Athletic Association, and the Duquesne Club.

H. L. Gilchrist addressed the Indiana Section of the American Chemical Society on the subject of "Chemical Warfare."

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